# NOAA Technical Memorandum NMFS


**DECEMBER 1992**

# THE HAWAIIAN MONK SEAL AT FRENCH FRIGATE SHOALS, 1988-89

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

## NOAA Technical Memorandum NMFS

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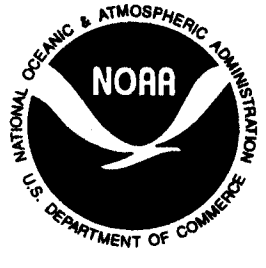


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Honolulu Laboratory,SWFSC
National Marine Fisheries Service, NOAA
2570 Dole Street
Honolulu, Hawaii 96822-2396

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**U.S. DEPARTMENT OF COMMERCE**
Barbara H. Franklin, Secretary
**National Oceanic and Atmospheric Administration**
John A. Knauss, Under Secretary for Oceans and Atmosphere
**National Marine Fisheries Service**
William W. Fox, Jr., Assistant Administrator for Fisheries

**ABSTRACT**

The endangered Hawaiian monk seal (*Monachus schauinslandi*) was studied at French Frigate Shoals (FFS) in the Hawaiian Islands National Wildlife Refuge from 4 April-31 August 1988 and from 25 March-4 September 1989.

Eight atoll-wide beach counts made in 1988 averaged 240 adults, subadults, and juveniles and 71 pups. At least 127 pups were born. By the end of the 1988 field season 5 pups were still nursing, and 118 of 121 (98%) pups had survived to weaning; 114 of those were tagged and 4 remained untagged. At least 7 pups were fostered by females other than their mothers. We assisted 2 of these fosterings. The mean axillary girth and standard length for recently weaned pups was 105 and 126 cm, respectively. Eight prematurely weaned female pups were collected and transported to Oahu to receive special care prior to release at Kure Atoll. Sixty-seven parturient females were identified from previous years; at least 46 gave birth in 1987. The mean interbirth interval for 12 of these was 382 days. Minimum first year survival of 1987 weaned and tagged pups was 98 of 106 (92%). Six male seals moved between Laysan Island and FFS. A juvenile was freed from entangling debris. Injuries to 37 seals were recorded. Five seals, including 3 pups, were presumed or found dead. Two of these seals, both juveniles, were necropsied.

Fifteen atoll beach counts made in 1989 averaged 278 adults, subadults, and juveniles and 58 pups. At least 120 pups were born, including the first pup known to have successfully weaned at Tern Island since at least 1947, and one by a five-year-old female, the youngest recorded to have pupped at FFS. By the end of the field season 4 pups were still nursing and 101 of 116 (87%) pups had survived to weaning; all 101 were tagged. At least 9 pups were fostered by females other than their mothers. The mean axillary girth and standard length for recently weaned pups was 102 and 125 cm, respectively. Three prematurely weaned female pups were collected and transported to Oahu for special care prior to release at Kure Atoll. Eighty-eight parturient females were identified from previous years; at least 47 gave birth in 1988. The mean interbirth interval for 16 of these was 374 days. Minimum first year survival of 1988 weaned and tagged pups was 78 of 114 (68%). Two male and two female seals moved between FFS and Laysan Island. Six seals were entangled in marine debris, and one was found stranded on the runway at Tern Island. Injuries to 92 seals were recorded. Thirty-four seals were presumed or found dead, including 15 neonatal pups and 1 prematurely weaned pup. Seven seals were necropsied.

**CONTENTS**


| | Page |
|---|---|
| Introduction | 1 |
| Materials and Methods | 1 |
| Censusing | 2 |
| Sex and Size/Age Designation, Tagging and Weaned Pup Measurement, and Individual Identification | 2 |
| Pup Collection for Rehabilitation | 3 |
| Collection of Tissue Samples | 3 |
| Marine Debris and Entanglement Studies | 3 |
| Injuries | 3 |
| Deaths | 3 |
| Results | 4 |
| Population | 4 |
| Atoll Censuses | 4 |
| Tern Island Censuses | 4 |
| Identified Seals | 5 |
| Births | 5 |
| Pup Fostering | 5 |
| Survival to Weaning | 7 |
| Pups Collected for Rehabilitation | 7 |
| Survival Through the First Full Year | 7 |
| Retagging | 7 |
| Inter-island Movement Between Laysan Island and FFS | 8 |
| Entanglements and Rescues | 8 |
| Injuries | 9 |
| Deaths-1988 | 10 |
| Deaths and Disappearances-1989 | 11 |
| Deaths | 11 |
| Disappearances | 14 |
| Conclusions | 15 |
| Acknowledgments | 15 |
| Citations | 16 |
| Tables | 19 |
| Figures | 57 |
| Appendixes | 67 |

## INTRODUCTION

The largest population of the Hawaiian monk seal (*Monachus schauinslandi*) is at French Frigate Shoals (FFS), 450 nmi northwest of Oahu. The history, geology, and biology of FFS through 1969 is described in Amerson (1971). Tern Island is the largest island in FFS and covers 37 acres; all the other islands range in size from <1 to 12 acres.

Johnson et al. (1982) summarized changes in the seal population at FFS between 1957 and 1978. Schulmeister (1981) described Tern Island censuses made between 1956 to 1980: essentially there were always less than 10 seals hauled out on Tern Island until 1979. Since 1979 the seal counts at Tern Island have increased to a high of 181 seals in 1985 (Eliason et al. in prep.). Fairaizl (1984) reported haul-out patterns of identifiable monk seals at FFS from January-September 1983.

Long-term research and population monitoring began at FFS in 1980 with the work of Johnson and Johnson (1984). The National Marine Fisheries Service (NMFS), Southwest Fisheries Science Center, Honolulu Laboratory began annual studies in 1982. The NMFS began tagging weaned pups at FFS in 1984 using plastic Temple Tags[1] (cattle ear tags). In earlier studies an average of 37% of weaned pups with an axillary girth measurement less than 90 cm had survived to their first year (NMFS, unpublished data). Consequently, the NMFS began collecting undersized weaned female pups in 1984. These pups received special care on Oahu and were released as yearlings at Kure Atoll as part of a program to aid in the recovery of the population there (Gilmartin and Gerrodette 1986).

During 1988 and 1989, the primary objectives at FFS were to conduct atoll-wide beach censuses of monk seals to assess productivity, survival, movements between atolls and islands, and population structure and distribution. Secondary objectives were to monitor reproduction of identified females, tag weaned pups, collect weaned female pups with an axillary girth measurement less than 90 cm for rehabilitation, collect tissue samples when tagging weaned pups and juveniles for DNA fingerprinting, record injuries and deaths, perform necropsies, and catalogue and destroy debris capable of entangling wildlife. This report presents the results of this work.

## MATERIALS AND METHODS

The NMFS field camp for FFS was based at Tern Island from 4 April-31 August 1988 and from 25 March-4 September 1989 (See Appendixes A and B for itineraries).

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[1]The use of brand-name products does not constitute endorsement by the National Marine Fisheries Service.

## Censusing

FFS is made up of 10 permanent islands, including La Perouse Pinnacle, and 7 semi-permanent sand spits (Fig. 1). Atoll censuses were counts of all seals hauled out on all beaches of the FFS; island censuses were counts on single islands. We began seasonal atoll-wide censuses on 12 April 1988 and 29 March 1989 using the standard census form (Forsyth et al. 1988) and following the coding instructions in Gerrodette and Frizelle (1988). For 1989, these instructions were revised (Appendix C). Tern Island censuses were made weekly throughout the year.

Atoll censuses were conducted every 1-2 weeks, and took 2 consecutive days to complete. Counts were made beginning between 0900 and 1000 and ending between 1500 and 1700. During atoll censuses the islands were visited in the same order. Island censuses started around 1300. Round Island and Mullet Island were censused from a boat or from a nearby reef, while the remaining islands were censused on foot by one or two persons (walking in opposite directions). Seven of the larger islands had been divided into unequal sectors using artificial or natural landmarks (Figs. 2 and 3).

## Sex and Size/Age Designation, Tagging and Weaned Pup Measurement, and Individual Identification

During each census observers assigned a size/age and sex to each seal, recorded tag numbers and colors, and made drawings of individual markings and injuries. Sex and size/age classification followed Stone (1984). To assign a sex, the observer had to see teats of a female, the penile opening and/or hairline between the opening and the anus of a male, or must have observed that a seal was lactating.

Since 1984, weaned pups have had standard length and axillary girth measured and one yellow Temple Tag attached in the webbing of each hind flipper (Gilmartin et al. 1986). Identifiable immature seals that had broken or missing tags were retagged. Weaned pups of 1988 and 1989 were tagged and measured in the same manner.

Photographs and drawings of seals with natural bleach marks, scars, and unusual physical characteristics (amputations, clouded eyes, deformed limbs, etc.) were made to augment individual identification files begun before 1980. New permanent four-character identification (ID) numbers (always beginning with the letter Y to indicate a seal from FFS) were assigned to newly tagged weaned pups and to untagged seals identified in 2 or more seasons. Temporary ID numbers (never beginning with the letter Y) were assigned to seals not identified previously and to all parturient seals to indicate the pupping site and order for each island in each year (i.e., E41-88 was the forty-first seal to pup on East Island in 1988; the prefix E = East, W = Whaleskate,

R = Round, TN = Tern, T = Trig, SH = Shark, LG = Little Gin, G = Gin, M = Mullet, D = Disappearing).

## Pup Collection for Rehabilitation

Female pups whose girth measured less than 90 cm within 2 weeks after weaning were collected, if transport was available within 2 weeks, and then sent to the NMFS's Kewalo Research Facility, Oahu in 1988 and Sea Life Park, Oahu in 1989. After gaining appropriate weight they were released at Kure Atoll.

## Collection of Tissue Samples

During the tagging procedure observers collected tissue from the webbing of the hind flippers using a leather punch. This tissue was frozen in the field and kept frozen at the NMFS laboratory until analyzed.

## Marine Debris and Entanglement Studies

All nets, lines, and other debris capable of entangling wildlife were collected, cataloged, and burned. For each debris item observers recorded: (1) weight; (2) dimensions (length of rope or area of net, twine diameter and stretch-mesh of net); (3) debris type (net, line, other), material (monofilament, nylon, polypropylene, cotton, hemp, and other), and color; (4) collection location; and (5) date.

## Injuries

Injuries for each year were those first observed at any time during the calendar year, and were categorized as punctures, abcesses, abrasions, lacerations, gaping wounds, circular wounds, or amputations. The general condition of the seals (alertness and fatness) was described as well as the wound observation date, location on the body, dimensions (length, width, and depth or height), condition (fresh, recent, or old), and cause (either known--actually witnessed, probable--cause known but not witnessed, or unknown). Photographs and drawings of the injuries were made, and the healing progress of resighted seals was recorded.

## Deaths

Recently dead seals were necropsied following procedures described in Winchell (1990). These seals were examined for abnormalities and injuries; major organs were sampled; and observations were recorded on a Monk Seal Necropsy Report Form (Appendix D).

# RESULTS

## Population

### Atoll Censuses

In 1988, observers made 8 atoll censuses from 27 May-15 July (Table 1, Fig. 4). The beach count of all seals averaged 311 (range 286-353, SD = 23.5) and, excluding pups, 240 (range 211-280, SD = 20.8) (Table 2). In 1989, the total count from 15 atoll censuses between 16 April and 28 August averaged 336 (range 280-377, SD = 29.7) and, excluding pups, 278 (range 222-317, SD = 29.9) (Tables 1, 2, and Fig. 5).

The seasonal fluctuation in atoll census totals was similar in both 1988 and 1989. The least biased comparison between years would use the censuses made during the same months of each year. The counts were lowest in late May and early June for juveniles and subadults and in mid June and July for adults (Figs. 4 and 5). However, atoll counts of adults were lower in 1989, while counts of subadults were lower in 1988. Inconsistent size estimations of seals may have caused this difference, since the sum of adults plus subadults was similar in both years. The highest age/sex class counts coincided with peak molting periods for those groups as observed earlier by Johnson and Johnson (1984).

Counts of adult males were lower than counts of adult females in both years (Fig. 6). The sex ratio of these counts were potentially biased because only females were additionally identified by scars and natural markings. Also, lactating seals were always counted as females even if their teats were not visible, further biasing the counts toward females. Nonetheless, even if all the unknown adults were considered males, the average sex ratio of adults would still be biased towards females.

### Tern Island Censuses

Throughout 1988 and 1989, the U.S. Fish and Wildlife Service (FWS) and NMFS personnel conducted weekly censuses of seals on Tern Island (Tables 3 and 4, Figs. 7 and 8). The mean beach count of all seals in 1988 was 72 (range 34-123, SD = 21.3) and, excluding pups, 71 (range 34-118, SD = 19.9) (Table 5). In 1989 the mean totals were 84 (range 48-155, SD = 21.0) and 82 (range 48-151, SD = 19.6) with and without pups, respectively (Table 5).

The highest counts at Tern Island were found to be in late fall and early winter when adult males hauled out to molt. Adult females and subadults and juveniles of both sexes molted at Tern Island during late summer and fall.

## Identified Seals

In 1988, observers identified 554 seals: 114 tagged pups (Table 6), 130 adult females, 3 adult males, and 307 tagged seals (1-4 years old) (Table 7). In 1989, the total was 597: 101 tagged pups (Table 8), 137 adult females, 2 adult males, and 358 tagged seals (1-5 years old) (Table 7). The identified seals accounted for an unknown fraction of the total population.

## Births

At least 127 pups were born in 1988: 61 females, 54 males, and 12 of unknown sex (Table 6). At least 120 pups were born in 1989: 54 females, 54 males, and 12 of unknown sex (Table 8). Prior to the beginning of the NMFS field season, usual pupping sites were not frequently visited. During the season the smallest islands, Round and Mullet Islands, were not as closely approached as other pupping sites. Consequently, we did not identify every female that pupped and may have missed neonatal deaths or disappearances of prematurely weaned pups.

During both years, an average of 50% of pups were born on East Island and 40% on Whaleskate and Round Islands (Tables 6 and 8). Remaining pups were born on Little Gin, Gin, Trig, Tern, and Mullet Islands in 1988 and Little Gin, Gin, Trig, Tern, and Shark Islands in 1989 (Fig. 1). In 1989, for the first time in at least 47 years (Kenyon 1972, NMFS unpublished data), a pup successfully weaned on Tern Island.

During 1988 and 1989, 114 and 101 pups were tagged, respectively. The mean axillary girth for pups tagged within 2 weeks of weaning was 105 cm in 1988 ($N = 62$, $SD = 11.8$) (Table 6), and 102 cm in 1989 ($N = 37$, $SD = 13.2$) (Table 8). The mean length of these pups was 126 cm in 1988 ($N = 63$, $SD = 8.6$) (Table 6), and 125 cm in 1989 ($N = 37$, $SD = 8.8$) (Table 8).

In 1988 and 1989, 46 and 47 parturient females, respectively, were known to have pupped in the preceding year (Henderson in prep., Tables 9 and 10). For 12 females whose exact pupping dates were known for 1987 and 1988 the mean interval between births was 382 days ($SD = 13.6$). For 16 females whose exact pupping dates were known for 1988 and 1989 the mean interval between births was 374 days ($SD = 16.5$).

A 5-year-old female pupped at FFS in 1989. This is the earliest recorded age of first reproduction in the Hawaiian monk seal (Johanos et al. 1990). She was the only one of 29 5-year-old females in her cohort known to have pupped.

## Pup Fostering

In 1988, at least 7 pups were fostered by mothers other than their own. Observers united two abandoned pups with females that

had recently lost their pups (Gerrodette et al. 1992). A description of the circumstances and location of these natural and human-assisted fosterings follows.

Case 1. The sizes of pups at East Island attended by females Y563 and Y227 changed dramatically between 15 and 25 July, suggesting that these females were fostering other seals' pups.

Case 2. Between 23 and 24 May at Whaleskate Island adult females Y022, Y150, and Y059 had exchanged pups. The result was that Y022 had no pup, Y150 had either Y022's or Y059's pup, and Y059 had two pups--either Y022's or its own pup, plus Y150's pup. On 25 May the circumstances were the same except that Y059 had rejected YF61, one of the two pups. Consequently, we placed YF61 2 m from female Y022. This pup vocalized, Y022 approached and presented its ventral, and YF61 began suckling.

Case 3. Between 25 and 26 May, Y022 switched pups with Y072 at Whaleskate Island. At weaning from Y072, YF61's girth was normal.

Case 4. An abandoned pup, YF82, had been separated from its mother at Whaleskate Island on 15 June and was found 3.4 miles away at Tern Island on 16 June. This pup was returned to Whaleskate Island the same day and introduced to a recently lactating female, Y061, without her own pup. She rejected the pup mildly at first but subsequently nursed and weaned it.

In 1989, at least 9 pups were fostered by mothers other than their own. A description of the circumstances and locations of these fosterings follows.

Case 1. Y523 had a male pup on 22 April and a female pup on 20 May at East Island.

Case 2. The neonatal pup of E17-89 died (death No. 31FFS89) on East Island 28 April. Later that day E17-89 accepted Y610's pup, YU03. On 30 April, E17 had rejected the pup. Pup YU03 was collected for rehabilitation.

Case 3. Female Y576 switched pups with female Y575 on 1 May at East Island.

Case 4. Female Y063 switched with female Y576 (who was fostering female Y575's pup) on 2 May. Y063's neonatal pup (now with female Y576) was not seen after 2 May (death No. 32FFS89).

Case 5. Observers found female Y583 at Trig Island on 5 May with two pups--both hers and female Y623's. On 30 May Y583 had her pup and Y623's pup had weaned.

Cases 6 and 7. The disparity between 2 June and 6 June in the size of pups being nursed by female's Y272 and Y521 at East Island suggested that these females were fostering other seals' pups.

Case 8. On 17 July, recently parturient female Y209 was fostering an unusually large pup on East Island. Y209's pup was separated from her on 9 July. Her smaller pup remained separated and subsequently disappeared on 10 August (death No. 27FFS89).

## Survival to Weaning

In 1988 and 1989, the survival of pups from birth to weaning was 98% (118 of 121) and 87% (101 of 116), respectively (Tables 6 and 8). Between 20 May and 10 August, in both years, East Island was inspected on average once every 3 days and other pupping islets except Whaleskate Island were inspected once every 8 days. Whaleskate Island was inspected once every 4 days in 1988 and once every 7 days in 1989. During this comparable effort one pup was found dead in 1988, whereas 2 pups were found dead and 4 had disappeared in 1989.

## Pups Collected for Rehabilitation

Observers collected 8 and 3 recently weaned and tagged female pups in 1988 and 1989, respectively, with axillary girths below 90 cm. They were transported to NMFS's Kewalo Research Facility on Oahu in 1988 and to Sea Life Park on Oahu in 1989. (See Tables 6 and 8 for tagging/collection dates and weaning islands; see Appendixes A and B for transportation dates.)

## Survival Through the First Full Year

The minimum survival through the first full year of pups tagged in 1987 and 1988 was 92% (98 of 106) and 68% (78 of 114), respectively (Table 11). These survival rates include seals sighted in 1989, 1990, and 1991 (NMFS, unpublished data). In order to standardize survival calculations, the female pups collected for rehabilitation are included in the tagged total but were considered to be dead in subsequent years.

## Retagging

During 1988, observers replaced broken or lost tags on 4 immature seals (Table 12), and during 1989 tags were replaced on 48 seals (Table 13). Effort had been increased in 1989, compared to 1988. Thirty-three of the 48 retagged in 1989 were originally tagged in 1986, a year when the tags were engraved too deeply and were observed to break easily.

## Inter-island Movement Between Laysan Island and FFS

During 1988, 2 adult males moved from Laysan Island to FFS (Table 14). Between 1987 and 1988 a male, born at Laysan Island in 1985, moved from Laysan Island to FFS and 2 males, born at FFS in 1984 and 1986, moved to Laysan Island from FFS. Between 1986 and 1988 a male, born at Laysan Island in 1984, moved from Laysan Island (Johanos et al. 1990) to FFS.

During 1989, 2 adult females moved from Laysan Island to FFS and a male, born at FFS in 1984, moved to Laysan Island from FFS (Becker et al. in prep., Table 14). One of these adult females pupped at FFS in 1989, the other had pupped at FFS at least 4 times previously but apparently did not pup there in 1989. Both females returned to Laysan Island in 1989. One male, born at Laysan Island in 1986, moved from Laysan Island to FFS between 1988 and 1989.

## Entanglements and Rescues

In 1988, one seal was found entangled in debris (Table 15). This juvenile female had a plastic screen cone around her neck on Shark Island, 13 June. An unsuccessful attempt was made to remove the cone, but later that day the cone was removed when the seal hauled out on Tern Island. She was not injured.

In 1989, six seals were found entangled in debris (Table 15) and a seventh seal, not entangled, was stranded on the runway at Tern Island. A description of these seven cases follows.

Case 1. On 15 January (Tern Island, sector 1), two FWS personnel restrained a yearling male (YF59) and removed a net fragment from around his neck and torso. His movement had been partially restricted, but he was not injured.

Case 2. On 10 April (East Island, sector 7), a weanling male (YU01) was at the water's edge with a piece of copper wire loosely around his neck. This wire was part of the debris left on East Island from the LORAN station vacated in 1952. We removed the wire without restraining the seal. There was no injury.

Case 3. On 12 April (Tern Island, sector 4) an adult male had a 12 mm-wide nylon reinforced packing band snugly around his mid-torso. We removed the band with a hook on a long pole. There was no apparent injury, but the band had begun to wear away hair on his ventral side, leaving a mark that was visible the following day.

Case 4. On 8 May (Tern Island, sector 2), an adult male had a ring of 18 mm-diameter polypropylene line snugly around his mid-torso. We cut off the line without restraint. There was no apparent injury.

Case 5. On 11 June (Whaleskate Island, sector 1) a lactating adult female (W24-89) had a 10 mm-diameter nylon line very loosely around her neck. We collected the line after it fell off.

Case 6. On 14 June (Tern Island) a 2-year-old male (Y494) was on the runway at Tern Island, apparently unable to find his way back to the beach. We guided him toward the beach. He then moved to the water's edge and into the water 10 minutes later.

Case 7. On 5 July (Tern Island, sector 4) a subadult of unknown sex had a 12 mm-wide nylon-reinforced packing band snugly around its neck. We removed the band with pruning shears without restraining or disturbing the seal. There was no apparent injury.

## Injuries

Observers discovered 37 injured seals in 1988 (Table 16). Conspecifics injured 20 seals (54%). Eight of these injuries were large--probably from multiple male mating attempts. Sharks caused 8 injuries (22%): 4 from the cookie cutter shark (*Isistius brasiliensis*) and 4 severe injuries from larger sharks. The cause of the remaining 10 injuries (27%) could not be determined.

In 1989, 97 injuries to 94 seals were observed (Table 17). Conspecifics inflicted 22 injuries (20%) of which 5 were probably from multiple male mating attempts. Sharks caused 35 injuries (40%): 5 from the cookie cutter shark and 30 more severe injuries from larger sharks. Propeller strikes likely caused 11 injuries (10%). Another seal (injury No. 21) had its mandible severely damaged (immobile and twisted), a very unusual injury, apparently caused by a blow to its head. This male seal also had dorsal lacerations from mounting attempts by other seals. The cause of 29 (30%) injuries could not be determined.

Injuries were considered to be from propeller strikes when they were deep, had smooth edges, were slightly curved and lacked other lacerations near the injury (a shark bite typically has more than one tooth mark when lacerations are deep), or were uniformly spaced parallel gashes. One seal, apparently injured by a propeller (injury No. 09), was a pregnant female that pupped prematurely on Tern Island (only 321 days had passed since she had pupped the year before). She did not respond to her live pup, which subsequently drowned.

The 8 large, seal mating injuries observed in 1988 were inflicted on 7 adult females and 1 subadult female (Table 16). One adult female (injury No. 19) had weaned a pup between 26 May and 1 June and was severely injured on 23 June (22-28 days later). She successfully weaned a pup born 22 May 1989 (333 days after the injury). Another very severely injured adult female

(injury No. 24) was not seen after the injury or in 1989 and is probably dead. Four juveniles and 3 weaned pups were injured in 1988 on their dorsa from seal bites.

In 1989, the seals injured from multiple male mating attempts included a 4-year-old female (injury No. 65), two 5-year-old females (injuries No. 52 and 57), a 3-year-old male (injury No. 50), and an adult of unknown age and sex (injury No. 22) (Table 17). One of the 5-year-old females was Y335, the first 5-year-old known to have pupped at FFS. She was first observed with the fresh injury 37-48 days after weaning her pup. Nine other females (6 subadults and 3 adults, injuries No. 36, 41, 42, 43, 45, 48, 53, 55, 71) had less severe injuries likely associated with mating. Four weaned pups (injuries No. 72, 73, 75, 76) sustained dorsal injuries in 1989 at Whaleskate Island, probably from seal bites.

In December 1988, large, shark-inflicted wounds were observed on 3 juveniles and 1 weaned pup. In 1989, 30 seals had shark-inflicted injuries, including 12 adults, 5 subadults, 9 juveniles, and 4 weaned pups. Three of the injuries to weaned pups and 4 other bite injuries were inflicted in November and December of 1989 and observed on Tern Island. Only Tern Island was consistently censused by the FWS during this period in both years.

In 1988 and 1989, islands were visited at a similar rate between 21 May and 7 August. During that period, we observed 3 large shark-inflicted wounds in 1988, and 10 in 1989, suggesting an increase in shark attacks.

**Deaths--1988**

Between 11 April and 19 December, 1988 observers found five dead seals (Table 18). Information relating to these 5 deaths follows.

Case 1. Yearling female, YN42, found 23 May on Whaleskate Island (sector 1). Body condition was emaciated, the blubber thickness at the base of the sternum was 6 mm (the most emaciated seals are usually between 4-5 mm). She had a gash across the top of the snout and the right eye protruded unusually. There was evidence of hemorrhaging around the skull. She was last seen alive on 27 April at Whaleskate Island.

Case 2. Yearling male, YN23, found 20 July on Tern Island (sector 9). Body condition was nearly emaciated; blubber thickness at the base of the sternum measured 8 mm. The lungs contained frothy liquid, suggesting drowning. There were also various lacerations, gashes, and punctures, probably from shark bites. None of these injuries appeared deep enough to be life threatening. The stomach lining was slightly ulcerated. The

stomach contained numerous nematodes, parts of a lobster, and one octopus beak. The intestines were relatively full of digested food and contained at least one tapeworm. The seal was last seen alive without injuries on Shark Island on July 15. At that time he was thin.

Case 3. Newborn pup of unknown sex, YFX1, found 30 May on Whaleskate Island (sector 3). It had been dead at least 1 day. Its mother, Y206, was less than 2 meters away. The pup was very decomposed by the time Y206 left it. The pup was not necropsied.

Case 4. Newborn pup of unknown sex, YFX2, found 17 November by FWS personnel on Tern Island (sector 1). It was not necropsied.

Case 5. Newborn pup of unknown sex, YFX3, found 19 December on Tern Island (sector 1). It was not necropsied.

**Deaths and Disappearances--1989**

Between 3 February and November, 1989, 34 seals had either died or disappeared and were presumed dead (Table 18).

**Deaths--1989**

Information relating to 27 deaths follows.

Case 1. Yearling male, YF82, found 27 March on Tern Island (sector 4) with a large, fresh shark bite wound in the muscle layer just behind his left foreflipper. There was a trail of blood leading from the water up to the beach crest where the dead seal lay. The blubber thickness at the base of the sternum measured 7 mm. There were ulcers on the stomach wall, and the stomach contained 50-100 nematodes, two octopus beaks, and a few very small fish bones. The large intestines were full. He was seen alive without the wound on 26 March at Tern Island and his condition was thin, but not emaciated.

Case 2. Newborn female pup, YUX1, found 4 April on Tern Island (sector 4). The skin around the pup's umbilicus had pulled partially away so that her intestines had begun to protrude. The pup's mother, Y009, did not leave the vicinity for two days. YUX1 was decaying and therefore, not examined.

Case 3. Yearling female, YF15, found by FWS personnel on 3 February on Tern Island. She was seen alive, emaciated, and breathing laboriously, on 26 January on Tern Island. She was necropsied, and FWS personnel found that the gastrointestinal tract was empty.

Case 4. Yearling male, YF57, found desiccated by FWS personnel between 24 March and 31 March on Whaleskate Island (sector 5). He was last seen alive and emaciated on 26 January on Tern Island. YF57 was not necropsied.

Case 5. Newborn male pup, YUX2, found drowned 10 April on Tern Island (sector 3). YUX2 had followed his severely injured mother (injury No. 9, table 17) to the water's edge. The pup was not necropsied.

Case 6. Adult of unknown sex (no baculum was recovered, so it was assumed to be a female) found desiccated on 1 April on Whaleskate Island (sector 6). It was not necropsied.

Case 7. Yearling female, YF38, found bloated on 17 April on East Island. The seal was last seen alive on 30 March at East Island. YF38 was not necropsied.

Case 8. Newborn female pup, YUX3, found decayed on 17 April on East Island (sector 1). She still had 18-20 cm of her umbilicus. YUX3 was not necropsied.

Case 9. Two-year-old male, YN30, found desiccated on 16 April on Trig Island (sector 2). He was last seen alive on 9 December, 1988. YN30 was not necropsied.

Case 10. Juvenile male, untagged, found bloated on 11 April on Disappearing Island. There were only small cuts on the side of his head. He was not necropsied.

Case 11. Subadult male, untagged, found desiccated on 11 April on Disappearing Island. He was not necropsied.

Case 12. Subadult, untagged and of unknown sex, found decayed on 17 April on Disappearing Island.

Case 13. Newborn pup, YUX4, found on 22 April on East Island (sector 1). Its mother, Y574, was still less than 1 meter from the pup and very alert. YUX4 was not collected.

Case 14. Neonatal pup, YUX5, found on 4 May on Little Gin Island (sector 2). Its mother, Y382, remained 2 meters from the pup and alert. YUX5 was not collected.

Case 15. Three-year-old female, YL07, found desiccated on 17 April on Disappearing Island. FWS personnel had last seen her alive at Tern Island on 6 October 1988. YL07 was not necropsied.

Case 16. Neonatal pup, YUX6, found on 12 May on Whaleskate Island (sector 2). Its mother (W16-89) remained 3 meters away. YUX6 was not necropsied.

Case 17. Nine-day-old female pup, YUX7, found on 20 May on Tern Island (sector 3). Her mother, Y617, had appeared on Tern Island on 8 May with fresh shark-bite wounds (injury No. 27, Table 17). Y617 refused to nurse her pup during the evening of 19 May. When the pup was found dead, her stomach and intestines contained a small amount of viscous fluid and her anus was covered with feces. Blubber thickness at the base of the sternum measured 4.5 mm. Cause of death was unknown.

Case 18. Yearling female, YF96, found on 25 May on Tern Island (sector 8). Her body condition was thin but not emaciated, and blubber thickness at the base of her sternum measured 7 mm. Both the stomach and intestines contained numerous parasites and some digested food material. A 1-cm-diameter hole in the bone at the top of its skull appeared eroded on the edge as if old. She was last seen alive at Trig Island on 5 May. Cause of death was unknown.

Case 19. Yearling female, YF23, found decayed on 30 May on Trig Island (sector 1). The right foreflipper was lacerated, probably from a shark bite. She was emaciated on 18 May on Trig Island. YF23 was not necropsied.

Case 20. Adult male found on 11 June on Trig Island (sector 1). His body condition was emaciated, his teeth were very worn, and his blubber and fat both measured 10 mm at the base of the sternum. Stomach wall ulcers were not perforated. The stomach contained only numerous nematodes. The intestines contained a few small fish bones and nematodes. The seal's cause of death appeared age related.

Case 21. Two-year-old female, YN98, found on 25 June on Whaleskate Island (sector 4). Body condition was emaciated. She was alive on 14 June at Disappearing Island. YN98 was not necropsied.

Case 24. Three-year-old male, YL84, found on 21 July at Tern Island (sector 9). Body condition was emaciated. Small nematodes inundated the walls of his small intestines. Stomach wall ulcers were not perforated. The stomach contained numerous nematodes and a few fish bones. He was alive on 15 June at Whaleskate Island. Cause of death was unknown.

Case 26. Three-day-old female pup, YUXA, found decayed by FWS personnel on 3 August on East Island (sector 2). On 6 August her mother, Y459, was seen fostering a recently weaned pup, YU70. A brief necropsy revealed that the stomach contained only a small amount of thin fluid while the intestines were full of a viscous, yellow matter. Cause of death was unknown.

Case 28. Adult female, Y519, found on 22 August near Tern Island (sector 1). An adult male copulated with the carcass in shallow water at this time. Y519 had successfully weaned a pup between

2 June and 4 June. She was alive, 30% molted, and thin on 10 August at Tern Island. She had a few minor, fresh scratches on her dorsum and sides that were probably from the necrophilic male. Blubber and fat thickness at the base of the sternum measured 12 mm and 15 mm, respectively. The stomach lining had a few unperforated ulcers. The stomach contained only a small number of parasites. The small and large intestines were partially full of a yellow viscous fluid. The thoracic cavity around the lungs contained approximately a liter of thin, translucent, blood-colored liquid. She may have drowned.

Case 29. Immature, unknown sex, observed being attacked by large sharks on 25 August near East Island. From the length of the attack and the violence, blood, and "flying parts" observed, the observer concluded the seal had been killed.

Case 33. Four-year-old male, Y434, found by FWS personnel on 24 October on Tern Island (sector 6). His body condition was emaciated. The left jaw was severely injured, and there were a series of three parallel gashes on his rump, probably caused by a propeller.

Case 34. Newborn pup, YUXF, found by FWS personnel in November on Tern Island (sector 3). YUXF was not necropsied.

**Disappearances--1989**

Information relating to 7 disappearances follows.

Case 22. Prematurely weaned male pup, YU22, tagged 12 June on Whaleskate Island (sector 5). He was subsequently not seen and was presumed dead.

Case 23. Prematurely weaned male pup, YUX8, disappeared after 7 July from Whaleskate Island (sector 4). On 27 June, a thin adult female (W24-89) had a small male pup at the opposite end of the island from sector 4. W24-89 was subsequently not seen on the island, and there were no abandoned pups seen after 7 July. YUX8 was presumed dead.

Case 25. A nursing pup, YUX9, disappeared between 10 and 18 July from Shark Island. YUX9 was first observed 10 July with its severely injured mother Y011 (injury No. 56, Table 17). On 18 July, Y011 was on Tern Island, without a pup. There were no abandoned pups on Shark Island. The pup was presumed dead.

Case 27. Prematurely weaned male pup, YUXB, disappeared around 10 August from East Island. On 8 July YUXB was separated from his mother and subsequently never paired with a lactating female.

Case 30. One- to 3-day-old pup, YUXC, disappeared between 11 and 17 April from East Island. Its mother (Y630) was not on the island. No abandoned pups were observed on 17 April. YUXC was

presumed dead. Y630 was seen at East Island on 29 April without her pup.

Case 31. Newborn pup, YUXD, disappeared between 27 and 28 April from East Island (sector 5). YUXD tried to approach its mother (E17-89) 2 meters up a steep berm. Five minutes later both were in the water 10 meters from the beach. This unusually small adult female followed her pup as the current carried it away from the island. She did not attempt to guide or pull the pup back to shore. On 28 April, we found E17-89 without a pup. No abandoned pups were on the island. YUXD was presumed dead.

Case 32. Nursing pup, YUXE, disappeared after 2 May from East Island (sector 1). A nursing pup, YU26, belonging to adult female Y575 was abandoned after a pup switch with another lactating adult female, Y576, earlier in the day. YU26 found the newly parturient female Y063 and displaced her 2-day-old pup YUXE. YUXE disappeared and was presumed dead.

## Conclusions

The number of seals counted on the beaches and pup production between 1988-1989 was the highest recorded at FFS. The minimum numbers of pups born from 1983-1986 was 98, 106, 96, and 108, respectively (Gilmartin et al. in press) compared to 121, 127, and 120 for 1987-1989.

Although it appears this population continues to grow, there are indications of instability: (1) a larger number of undersized weaned pups in 1988--8 compared to 3 in 1986 and 0 in 1987, (2) fewer pups survived to weaning in 1989 compared to 1988, and (3) fewer pups that weaned in 1988 survived the first year--68% compared to a mean of 90% for the 1984-87 weaned pups.

Of 10 1- through 4-year-olds found freshly dead in both years, all had been considered thin or emaciated just prior to or at the time of death, suggesting some food or disease related stress. There may also have been an increase in shark attacks in 1989 affecting mortality rates. Importantly, incidents of propeller injuries and human interactions (injury No. 21, Table 17) were observed that present serious, though previously unrecognized, impediments to the Hawaiian monk seal's recovery.

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## CITATIONS

Amerson, A. Binion, Jr.
1971. The natural history of French Frigate Shoals, Northwestern Hawaiian Islands. Atoll Res. Bull. 150:1-303.

Becker, Brenda L., Lisa M. Hiruki, and Steven A. Zur.
In prep. The Hawaiian monk seal at Laysan Island: 1989.

Eliason, Julie J. and John R. Henderson.
In prep. Hawaiian monk seal observations at French Frigate Shoals, 1984.

Eliason, Julie J., Marc A. Webber, and John R. Henderson.
In prep. Hawaiian monk seal observations at French Frigate Shoals, 1985.

Fairaizl, Gale W.
1984. Intra-atoll resightings of the Hawaiian monk seal, *Monachus schauinslandi*, at French Frigate Shoals, 1 January 1983-31 August 1983. Southwest Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Sci. Cent. Admin. Rep. H-84-5C, 27 p.

Forsyth, Robert G., Doris J. Alcorn, Tim Gerrodette, and William G. Gilmartin.
1988. The Hawaiian monk seal and green turtle on Pearl and Hermes Reef, 1986. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-107, 24 p.

Gerrodette, Tim, and Fred R. Frizelle, III.
1988. Checking procedures for Hawaiian monk seal census data. Southwest Fish. Cent., Natl. Mar. Fish Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Sci. Cent. Admin. Rep. H-88-13, 140 p.

Gerrodette, Tim, Mitchell P. Craig, and Thea C. Johanos.
1992. Human assisted fostering in the Hawaiian monk seal. 'Elepaio 52:43-46.

Gilmartin, William G., and Tim Gerrodette.
1986. Hawaiian monk seal population status and recovery potential at Kure Atoll. Southwest Fish. Sci. Cent., Natl. Mar. Fish Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Sci. Cent. Admin. Rep. H-86-16, 26 p.

Gilmartin, William G., Robert J. Morrow, and Anne M. Houtman.
1986. Hawaiian monk seal observations and captive maintenance project at Kure Atoll, 1981. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-59, 9 p.

Gilmartin, William G., Thea C. Johanos, and Tim Gerrodette.
In press. Estimates of population size for Hawaiian monk seal, *Monachus schauinslandi*, 1983-1988. Mar. Mam. Sci.

Henderson, John R.
In prep. The Hawaiian monk seal on French Frigate Shoals: 1986-1987.

Johanos, Thea C., Brenda L. Becker, Mary A. Brown, Barry K. Choy, Lisa M. Hiruki, Russell E. Brainard, and Robin L. Westlake.
1990. The Hawaiian monk seal on Laysan Island: 1988. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-151, 44 p.

Johnson, Patricia A., and Brian W. Johnson.
1984. Hawaiian monk seal observations on French Frigate Shoals, 1980. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-50, 47 p.

Johnson, Ancel M., Robert L. DeLong, Clifford H. Fiscus, and Karl W. Kenyon.
1982. Population status of the Hawaiian monk seal (*Monachus schauinslandi*), 1978. J. Mammal. 63:415-421.

Kenyon, Karl W.
1972. Man versus the monk seal. J. Mammal. 53:687-696.

Schulmeister, Susan
1981. Hawaiian monk seal numbers increase on Tern Island. 'Elepaio 41:62-63.

Stone, H. Sheridan.
1984. Hawaiian monk seal population research, Lisianski Island, 1982. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-47, 33 p.

Winchell, Jane M.
1990. Field manual for phocid necropsies (specifically *Monachus schauinslandi*). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-146, 54 p.

# TABLES

Table 1.--Atoll censuses of French Frigate Shoals in 1988 and 1989 (M = male, F = female, and U = unknown).

| | Adults | | | Subadults | | | Juveniles | | | Pups | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date[a] | M | F | U | M | F | U | M | F | U | M | F | U | Non-pup | Pup | Grand |
| **1988** | | | | | | | | | | | | | | | |
| 5/27 | 27 | 64 | 35 | 10 | 14 | 20 | 20 | 31 | 5 | 9 | 12 | 44 | 227[b] | 65 | 292 |
| 6/ 1 | 29 | 60 | 34 | 14 | 12 | 16 | 32 | 28 | 15 | 13 | 6 | 44 | 240 | 63 | 303 |
| 6/12 | 28 | 49 | 49 | 10 | 11 | 25 | 13 | 12 | 14 | 16 | 13 | 48 | 211 | 77 | 288 |
| 6/17 | 24 | 48 | 44 | 17 | 15 | 21 | 21 | 23 | 14 | 14 | 7 | 37 | 228[b] | 58 | 286 |
| 6/24 | 20 | 68 | 45 | 13 | 12 | 22 | 26 | 19 | 10 | 21 | 15 | 43 | 236[b] | 79 | 315 |
| 6/30 | 22 | 68 | 52 | 16 | 24 | 14 | 27 | 27 | 6 | 14 | 9 | 48 | 256 | 71 | 327 |
| 7/10 | 17 | 71 | 37 | 18 | 25 | 35 | 20 | 16 | 4 | 24 | 20 | 40 | 243 | 84 | 327 |
| 7/14 | 25 | 54 | 58 | 27 | 27 | 29 | 27 | 25 | 8 | 16 | 16 | 41 | 280 | 73 | 353 |
| **1989** | | | | | | | | | | | | | | | |
| 4/16 | 35 | 52 | 33 | 18 | 33 | 26 | 55 | 56 | 7 | 1 | 3 | 12 | 317 | 16 | 333 |
| 4/24 | 27 | 51 | 31 | 36 | 23 | 32 | 50 | 45 | 15 | 4 | 4 | 18 | 311 | 26 | 337 |
| 5/ 4 | 26 | 66 | 31 | 33 | 30 | 21 | 38 | 33 | 3 | 2 | 5 | 33 | 282 | 40 | 322 |
| 5/11 | 38 | 60 | 27 | 20 | 25 | 22 | 40 | 32 | 8 | 5 | 4 | 31 | 273 | 40 | 313 |
| 5/29 | 28 | 59 | 27 | 28 | 19 | 10 | 31 | 19 | 5 | 8 | 11 | 34 | 227 | 53 | 280 |
| 6/14 | 13 | 59 | 11 | 34 | 28 | 15 | 31 | 22 | 8 | 24 | 17 | 29 | 222 | 70 | 292 |
| 6/26 | 16 | 45 | 21 | 23 | 15 | 48 | 25 | 16 | 30 | 22 | 17 | 43 | 239 | 82 | 321 |
| 7/ 9 | 15 | 64 | 7 | 46 | 45 | 21 | 35 | 36 | 7 | 25 | 18 | 36 | 276 | 79 | 355 |
| 7/19 | 11 | 62 | 19 | 32 | 32 | 49 | 40 | 35 | 25 | 27 | 23 | 22 | 305 | 72 | 377 |
| 7/26 | 15 | 53 | 30 | 36 | 28 | 42 | 39 | 32 | 14 | 32 | 15 | 29 | 289 | 76 | 365 |
| 8/ 3 | 19 | 45 | 39 | 31 | 32 | 47 | 36 | 31 | 18 | 29 | 18 | 29 | 298 | 76 | 374 |
| 8/ 9 | 20 | 49 | 25 | 37 | 44 | 35 | 44 | 35 | 5 | 27 | 18 | 23 | 294 | 68 | 362 |
| 8/13 | 7 | 46 | 22 | 39 | 35 | 31 | 46 | 37 | 17 | 26 | 17 | 16 | 280 | 59 | 339 |
| 8/21 | 19 | 50 | 23 | 42 | 31 | 33 | 52 | 38 | 13 | 17 | 28 | 4 | 301 | 59 | 360 |
| 8/27 | 17 | 44 | 22 | 32 | 25 | 23 | 46 | 37 | 9 | 24 | 20 | 9 | 255 | 53 | 308 |

[a]Date refers to first day of the 2-day atoll census.
[b]Total includes one seal not assigned specific age class.

Table 2.--Summary statistics of atoll censuses in 1988 and 1989 (M = male, F = female, and U = unknown).

| | Adults | | | Subadults | | | Juveniles | | | Pups | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | M | F | U | M | F | U | M | F | U | M | F | U | Non-pup | Pup | Grand |
| **1988** | | | | | | | | | | | | | | | |
| Mean | 24.0 | 60.2 | 44.2 | 15.6 | 17.5 | 22.8 | 23.2 | 22.6 | 9.5 | 15.9 | 12.2 | 43.1 | 240.1 | 71.2 | 311.4 |
| Std.dev. | 4.1 | 9.0 | 8.6 | 5.5 | 6.6 | 6.8 | 5.9 | 6.5 | 4.4 | 4.7 | 4.8 | 3.8 | 20.8 | 8.8 | 23.5 |
| **1989** | | | | | | | | | | | | | | | |
| Mean | 20.4 | 53.7 | 24.5 | 32.5 | 29.7 | 30.3 | 40.5 | 33.6 | 12.3 | 18.9 | 57.9 | 24.5 | 277.9 | 57.9 | 335.9 |
| Std.dev. | 8.8 | 7.4 | 8.3 | 7.8 | 8.1 | 12.2 | 8.4 | 9.8 | 7.7 | 11.2 | 7.5 | 11.0 | 29.9 | 20.0 | 29.8 |

Table 3.--Censuses of Tern Island in 1988 (M = male, F = female, and U = unknown).

| Date | Adults | | | Subadults | | | Juveniles | | | Pups | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | U | M | F | U | M | F | U | M | F | U | Non-pup | Pup | Grand |
| 1/ 5 | 13 | 18 | 14 | 23 | 2 | 15 | 10 | 6 | 2 | 0 | 0 | 0 | 103 | 0 | 103 |
| 1/12 | 8 | 13 | 17 | 8 | 7 | 0 | 5 | 6 | 5 | 1 | 0 | 1 | 69 | 2 | 71 |
| 1/19 | 11 | 7 | 15 | 8 | 3 | 4 | 4 | 2 | 0 | 0 | 0 | 0 | 54 | 0 | 54 |
| 1/27 | 19 | 15 | 16 | 11 | 6 | 5 | 3 | 7 | 0 | 0 | 0 | 0 | 82 | 0 | 82 |
| 2/ 3 | 22 | 16 | 17 | 7 | 6 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 73 | 0 | 73 |
| 2/ 9 | 18 | 12 | 14 | 7 | 6 | 1 | 2 | 4 | 0 | 0 | 0 | 0 | 64 | 0 | 64 |
| 2/16 | 22 | 10 | 15 | 10 | 4 | 5 | 4 | 5 | 2 | 0 | 0 | 0 | 77 | 0 | 77 |
| 2/24 | 17 | 14 | 11 | 11 | 5 | 2 | 6 | 4 | 0 | 0 | 0 | 0 | 70 | 0 | 70 |
| 3/ 1 | 9 | 12 | 13 | 10 | 8 | 4 | 3 | 3 | 0 | 0 | 0 | 0 | 62 | 0 | 62 |
| 3/ 8 | 10 | 9 | 12 | 10 | 12 | 4 | 7 | 3 | 1 | 0 | 0 | 0 | 68 | 0 | 68 |
| 3/15 | 19 | 10 | 3 | 16 | 11 | 9 | 8 | 7 | 1 | 0 | 0 | 0 | 84 | 0 | 84 |
| 3/22 | 22 | 6 | 11 | 8 | 0 | 2 | 5 | 5 | 0 | 0 | 0 | 0 | 59 | 0 | 59 |
| 3/29 | 8 | 9 | 5 | 10 | 6 | 1 | 5 | 6 | 0 | 0 | 0 | 0 | 50 | 0 | 50 |
| 4/ 5 | 11 | 11 | 12 | 11 | 4 | 3 | 3 | 6 | 3 | 0 | 0 | 0 | 64 | 0 | 64 |
| 4/12 | 7 | 9 | 6 | 8 | 4 | 8 | 2 | 8 | 4 | 0 | 0 | 0 | 56 | 0 | 56 |
| 4/20 | 13 | 4 | 20 | 4 | 7 | 9 | 6 | 7 | 3 | 0 | 0 | 0 | 73 | 0 | 73 |
| 4/24 | 11 | 6 | 12 | 4 | 7 | 5 | 0 | 3 | 0 | 0 | 0 | 0 | 48 | 0 | 48 |
| 4/25 | 11 | 10 | 10 | 6 | 3 | 4 | 3 | 1 | 0 | 0 | 0 | 0 | 48 | 0 | 48 |
| 4/26 | 15 | 11 | 8 | 6 | 5 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 49 | 0 | 49 |
| 5/ 2 | 12 | 10 | 20 | 2 | 2 | 3 | 8 | 1 | 1 | 0 | 0 | 0 | 59 | 0 | 59 |
| 5/ 4 | 10 | 8 | 16 | 3 | 4 | 1 | 4 | 5 | 1 | 0 | 0 | 0 | 52 | 0 | 52 |
| 5/ 6 | 13 | 8 | 16 | 1 | 6 | 2 | 3 | 3 | 2 | 0 | 0 | 0 | 54 | 0 | 54 |
| 5/ 7 | 7 | 14 | 9 | 5 | 2 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 46 | 0 | 46 |
| 5/10 | 11 | 4 | 20 | 5 | 3 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 50 | 0 | 50 |
| 5/11 | 18 | 5 | 10 | 7 | 4 | 1 | 3 | 4 | 0 | 0 | 0 | 0 | 52 | 0 | 52 |
| 5/15 | 10 | 7 | 19 | 8 | 5 | 11 | 2 | 3 | 1 | 0 | 0 | 0 | 66 | 0 | 66 |
| 5/22 | 10 | 7 | 3 | 4 | 6 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 35 | 0 | 35 |
| 5/28 | 10 | 5 | 12 | 6 | 6 | 8 | 5 | 5 | 0 | 0 | 0 | 0 | 57 | 0 | 57 |
| 6/ 2 | 7 | 7 | 8 | 7 | 7 | 4 | 6 | 5 | 0 | 0 | 0 | 0 | 51 | 0 | 51 |
| 6/ 8 | 8 | 5 | 7 | 0 | 3 | 6 | 1 | 4 | 0 | 0 | 0 | 0 | 34 | 0 | 34 |
| 6/13 | 13 | 9 | 19 | 3 | 1 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 52 | 0 | 52 |
| 6/18 | 7 | 9 | 13 | 8 | 4 | 8 | 1 | 4 | 2 | 0 | 0 | 0 | 56 | 0 | 56 |
| 6/25 | 7 | 15 | 16 | 4 | 3 | 6 | 6 | 1 | 1 | 2 | 0 | 0 | 59 | 2 | 61 |
| 7/ 1 | 8 | 15 | 16 | 10 | 12 | 5 | 2 | 4 | 0 | 0 | 0 | 0 | 72 | 0 | 72 |
| 7/10 | 4 | 13 | 17 | 6 | 6 | 17 | 6 | 0 | 0 | 0 | 0 | 0 | 69 | 0 | 69 |
| 7/15 | 12 | 17 | 10 | 18 | 7 | 17 | 5 | 4 | 2 | 0 | 1 | 0 | 92 | 1 | 93 |
| 8/ 6 | 8 | 14 | 16 | 10 | 6 | 5 | 3 | 7 | 1 | 1 | 2 | 0 | 70 | 3 | 73 |
| 8/12 | 9 | 6 | 24 | 9 | 11 | 14 | 6 | 5 | 1 | 0 | 1 | 1 | 85 | 2 | 87 |
| 8/19 | 10 | 9 | 13 | 9 | 7 | 7 | 1 | 6 | 2 | 0 | 0 | 0 | 64 | 0 | 64 |
| 8/22 | 8 | 10 | 20 | 7 | 8 | 4 | 4 | 9 | 0 | 2 | 1 | 0 | 70 | 3 | 73 |
| 8/28 | 9 | 3 | 28 | 15 | 5 | 12 | 3 | 8 | 1 | 2 | 0 | 0 | 84 | 2 | 86 |
| 9/ 9 | 2 | 3 | 1 | 21 | 4 | 13 | 7 | 5 | 0 | 1 | 0 | 0 | 56 | 1 | 57 |
| 9/15 | 5 | 3 | 4 | 26 | 6 | 12 | 5 | 6 | 1 | 1 | 0 | 0 | 68 | 1 | 69 |
| 9/22 | 0 | 1 | 1 | 21 | 9 | 15 | 4 | 5 | 2 | 0 | 2 | 0 | 58 | 2 | 60 |
| 9/29 | 17 | 13 | 28 | 7 | 2 | 4 | 3 | 4 | 0 | 0 | 1 | 1 | 78 | 2 | 80 |
| 10/ 6 | 1 | 1 | 10 | 4 | 6 | 37 | 2 | 4 | 0 | 0 | 3 | 1 | 65 | 4 | 69 |

Table 3.--Continued.

| Date | Adults | | | Subadults | | | Juveniles | | | Pups | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | U | M | F | U | M | F | U | M | F | U | Non-pup | Pup | Grand |
| 10/13 | 12 | 2 | 11 | 32 | 5 | 19 | 7 | 5 | 1 | 2 | 4 | 0 | 94 | 6 | 100 |
| 10/20 | 6 | 3 | 6 | 26 | 6 | 44 | 10 | 10 | 0 | 4 | 4 | 0 | 111 | 8 | 119 |
| 10/27 | 17 | 7 | 34 | 19 | 4 | 30 | 2 | 5 | 0 | 2 | 3 | 0 | 118 | 5 | 123 |
| 11/ 3 | 14 | 8 | 40 | 13 | 3 | 22 | 4 | 4 | 0 | 1 | 1 | 0 | 108 | 2 | 110 |
| 11/10 | 22 | 4 | 37 | 13 | 2 | 9 | 8 | 5 | 2 | 3 | 2 | 2 | 102 | 7 | 109 |
| 11/17 | 13 | 5 | 31 | 8 | 7 | 11 | 5 | 4 | 0 | 0 | 1 | 0 | 84 | 1 | 85 |
| 11/24 | 12 | 7 | 21 | 10 | 6 | 30 | 5 | 4 | 1 | 1 | 1 | 1 | 96 | 3 | 99 |
| 12/ 1 | 18 | 12 | 23 | 17 | 4 | 8 | 6 | 2 | 3 | 2 | 2 | 0 | 93 | 4 | 97 |
| 12/ 8 | 24 | 10 | 29 | 10 | 3 | 7 | 6 | 4 | 1 | 3 | 3 | 1 | 94 | 7 | 101 |
| 12/15 | 17 | 11 | 18 | 11 | 5 | 14 | 7 | 8 | 0 | 1 | 1 | 0 | 91 | 2 | 93 |
| 12/22 | 21 | 14 | 22 | 13 | 16 | 6 | 13 | 9 | 4 | 1 | 3 | 0 | 118 | 4 | 122 |
| 12/29 | 15 | 14 | 16 | 12 | 2 | 8 | 2 | 7 | 0 | 0 | 3 | 0 | 76 | 3 | 79 |

Table 4.--Censuses of Tern Island in 1989 (M = male, F = female, and U = unknown).

| Date | Adults | | | Subadults | | | Juveniles | | | Pups | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | U | M | F | U | M | F | U | M | F | U | Non-Pup | Pup | Grand |
| 1/13 | 18 | 11 | 22 | 7 | 7 | 3 | 6 | 4 | 1 | 0 | 0 | 0 | 79 | 0 | 79 |
| 1/18 | 21 | 10 | 28 | 8 | 6 | 2 | 1 | 5 | 1 | 0 | 0 | 0 | 82 | 0 | 82 |
| 1/26 | 20 | 12 | 25 | 7 | 6 | 7 | 6 | 6 | 1 | 0 | 0 | 0 | 90 | 0 | 90 |
| 2/ 2 | 23 | 11 | 12 | 7 | 6 | 4 | 6 | 7 | 0 | 0 | 0 | 0 | 76 | 0 | 76 |
| 2/ 9 | 16 | 13 | 9 | 6 | 4 | 3 | 1 | 6 | 0 | 0 | 0 | 0 | 58 | 0 | 58 |
| 2/16 | 19 | 10 | 21 | 14 | 10 | 2 | 6 | 8 | 4 | 0 | 0 | 0 | 94 | 0 | 94 |
| 2/23 | 22 | 15 | 16 | 5 | 3 | 3 | 4 | 3 | 0 | 0 | 0 | 0 | 71 | 0 | 71 |
| 3/ 2 | 27 | 10 | 10 | 9 | 11 | 2 | 7 | 7 | 0 | 0 | 0 | 0 | 83 | 0 | 83 |
| 3/ 9 | 15 | 7 | 7 | 6 | 7 | 14 | 6 | 6 | 1 | 0 | 0 | 0 | 69 | 0 | 69 |
| 3/16 | 9 | 12 | 8 | 9 | 7 | 2 | 4 | 5 | 0 | 0 | 0 | 0 | 56 | 0 | 56 |
| 3/23 | 10 | 15 | 8 | 13 | 5 | 10 | 8 | 6 | 1 | 0 | 0 | 0 | 76 | 0 | 76 |
| 3/31 | 15 | 8 | 6 | 4 | 7 | 3 | 3 | 4 | 1 | 0 | 0 | 0 | 51 | 0 | 51 |
| 4/ 7 | 11 | 13 | 15 | 13 | 10 | 11 | 4 | 8 | 0 | 0 | 0 | 0 | 85 | 0 | 85 |
| 4/13 | 16 | 13 | 8 | 7 | 7 | 2 | 6 | 8 | 1 | 0 | 0 | 0 | 68 | 0 | 68 |
| 4/16 | 16 | 10 | 8 | 2 | 12 | 0 | 10 | 11 | 0 | 0 | 0 | 0 | 69 | 0 | 69 |
| 4/25 | 14 | 10 | 8 | 14 | 6 | 9 | 6 | 4 | 2 | 1 | 0 | 0 | 73 | 1 | 74 |
| 5/ 3 | 6 | 11 | 9 | 14 | 5 | 9 | 8 | 3 | 1 | 0 | 0 | 1 | 66 | 1 | 67 |
| 5/ 5 | 9 | 15 | 12 | 11 | 7 | 2 | 11 | 7 | 0 | 1 | 0 | 0 | 74 | 1 | 75 |
| 5/12 | 11 | 6 | 10 | 6 | 5 | 7 | 10 | 3 | 1 | 1 | 0 | 1 | 59 | 2 | 61 |
| 5/18 | 12 | 13 | 4 | 9 | 11 | 5 | 7 | 6 | 0 | 1 | 0 | 1 | 67 | 2 | 69 |
| 5/26 | 19 | 16 | 7 | 10 | 7 | 1 | 3 | 9 | 1 | 1 | 0 | 0 | 73 | 1 | 74 |
| 5/30 | 6 | 7 | 8 | 16 | 11 | 6 | 5 | 2 | 2 | 0 | 0 | 0 | 63 | 0 | 63 |
| 6/15 | 5 | 10 | 1 | 14 | 11 | 4 | 8 | 2 | 0 | 1 | 0 | 0 | 55 | 1 | 56 |
| 6/23 | 8 | 14 | 2 | 2 | 9 | 7 | 2 | 3 | 1 | 0 | 0 | 0 | 48 | 0 | 48 |
| 6/27 | 7 | 8 | 5 | 11 | 4 | 16 | 5 | 6 | 2 | 0 | 0 | 0 | 64 | 0 | 64 |
| 7/ 7 | 4 | 10 | 4 | 9 | 14 | 6 | 7 | 3 | 0 | 1 | 0 | 0 | 57 | 1 | 58 |
| 7/10 | 4 | 18 | 5 | 14 | 13 | 5 | 7 | 5 | 1 | 1 | 0 | 0 | 72 | 1 | 73 |
| 7/20 | 5 | 15 | 7 | 15 | 14 | 8 | 9 | 8 | 2 | 0 | 0 | 0 | 83 | 0 | 83 |
| 7/27 | 8 | 17 | 12 | 15 | 12 | 8 | 6 | 8 | 3 | 1 | 0 | 0 | 89 | 1 | 90 |
| 8/ 4 | 6 | 9 | 16 | 18 | 16 | 23 | 7 | 12 | 3 | 2 | 0 | 0 | 110 | 2 | 112 |
| 8/10 | 11 | 19 | 8 | 18 | 18 | 7 | 6 | 8 | 1 | 1 | 1 | 0 | 96 | 2 | 98 |
| 8/14 | 3 | 15 | 11 | 16 | 17 | 12 | 7 | 6 | 4 | 1 | 3 | 0 | 91 | 4 | 95 |
| 8/22 | 8 | 20 | 6 | 14 | 14 | 10 | 11 | 7 | 3 | 0 | 1 | 0 | 93 | 1 | 94 |
| 8/28 | 7 | 12 | 10 | 12 | 10 | 9 | 11 | 6 | 0 | 1 | 2 | 0 | 77 | 3 | 80 |
| 9/14 | 11 | 15 | 20 | 11 | 8 | 10 | 5 | 2 | 0 | 2 | 1 | 0 | 82 | 3 | 85 |
| 9/22 | 24 | 17 | 19 | 8 | 5 | 3 | 4 | 5 | 0 | 0 | 0 | 0 | 85 | 0 | 85 |
| 9/28 | 15 | 5 | 26 | 8 | 6 | 1 | 8 | 13 | 0 | 1 | 1 | 0 | 82 | 2 | 84 |
| 10/14 | 11 | 15 | 22 | 8 | 7 | 5 | 5 | 9 | 0 | 1 | 1 | 0 | 82 | 2 | 84 |
| 10/19 | 30 | 17 | 25 | 7 | 3 | 0 | 5 | 4 | 1 | 2 | 5 | 0 | 92 | 7 | 99 |
| 10/26 | 26 | 14 | 31 | 6 | 4 | 6 | 7 | 4 | 2 | 1 | 5 | 0 | 100 | 6 | 106 |
| 11/ 2 | 27 | 8 | 37 | 4 | 7 | 3 | 5 | 2 | 1 | 1 | 3 | 2 | 94 | 6 | 100 |
| 11/ 9 | 36 | 11 | 36 | 1 | 3 | 3 | 3 | 5 | 0 | 1 | 3 | 0 | 98 | 4 | 102 |
| 11/16 | 54 | 18 | 43 | 6 | 9 | 7 | 7 | 6 | 1 | 1 | 3 | 0 | 151 | 4 | 155 |
| 11/24 | 26 | 8 | 49 | 12 | 5 | 5 | 8 | 10 | 1 | 2 | 2 | 0 | 124 | 4 | 128 |
| 11/30 | 29 | 8 | 29 | 5 | 3 | 4 | 6 | 9 | 1 | 2 | 3 | 0 | 94 | 5 | 99 |
| 12/ 7 | 29 | 17 | 24 | 10 | 9 | 4 | 9 | 6 | 0 | 1 | 2 | 0 | 108 | 3 | 111 |

Table 4.--Continued.

| Date | Adults | | | Subadults | | | Juveniles | | | Pups | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | U | M | F | U | M | F | U | M | F | U | Non-Pup | Pup | Grand |
| 12/14 | 20 | 16 | 37 | 10 | 8 | 9 | 8 | 10 | 1 | 3 | 4 | 1 | 119 | 8 | 127 |
| 12/21 | 21 | 12 | 32 | 6 | 9 | 6 | 6 | 7 | 1 | 1 | 2 | 0 | 100 | 3 | 103 |
| 12/28 | 22 | 15 | 16 | 14 | 8 | 5 | 7 | 3 | 0 | 2 | 1 | 0 | 90 | 3 | 93 |

Table 5.--Summary statistics for Tern Island censuses in 1988 and 1989 (M = male, F = female, and U = unknown).

| | Adults | | | Subadults | | | Juveniles | | | Pups | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | M | F | U | M | F | U | M | F | U | M | F | U | Non-pup | Pup | Grand |
| **1988** | | | | | | | | | | | | | | | |
| Mean | 12.0 | 9.0 | 15.4 | 10.1 | 5.4 | 8.8 | 4.3 | 4.6 | 0.9 | 0.5 | 0.7 | 0.1 | 70.6 | 1.3 | 71.9 |
| Std.dev. | 5.5 | 4.3 | 8.5 | 6.5 | 2.9 | 9.0 | 2.6 | 2.2 | 1.2 | 0.9 | 1.2 | 0.4 | 20.0 | 2.1 | 21.5 |
| **1989** | | | | | | | | | | | | | | | |
| Mean | 16.2 | 12.5 | 16.2 | 9.6 | 8.3 | 6.0 | 6.3 | 6.1 | 1.0 | 0.7 | 0.9 | 0.1 | 82.0 | 1.7 | 83.7 |
| Std.dev. | 9.9 | 3.7 | 11.6 | 4.3 | 3.8 | 4.4 | 2.4 | 2.7 | 1.1 | 0.8 | 1.4 | 0.4 | 19.8 | 2.1 | 21.2 |

Table 6.--Summary of pups born in 1988 (M = male, F = female, and U = unknown).

| ID NO. | Tag No.[a] L | Tag No.[a] R | | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Rehab[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YF00 | F00 | F100 | F | | | | Ea | | 04/22 | 109 | 135 | | |
| YF01 | F01 | F101 | M | | | | Ea | | 04/22 | 115 | 133 | | |
| YF02 | F02 | F102 | F | | | | WS | | 04/27 | 88 | 130 | | YES |
| YF03 | F03 | F103 | F | | | | WS | | 04/27 | 98 | 130 | | |
| YF04 | F04 | F104 | F | | | | WS | | 04/27 | 100 | 131 | | |
| YF05 | F05 | F105 | M | | | | WS | | 04/27 | 104 | 133 | | |
| YF06 | F06 | F106 | M | | | | WS | | 04/27 | 107 | 130 | | |
| YF07 | F07 | F107 | M | | | | WS | | 04/29 | 87 | 113 | | |
| YF08 | F08 | F108 | F | | | | Ea | | 04/30 | 75 | 125 | | YES |
| YF09 | F09 | F109 | F | | Ea | 04/23-30 | Ea | | 05/01 | 89 | 119 | | YES |
| YF10 | F10 | F110 | F | | | | WS | | 05/08 | 107 | 128 | | |
| YF11 | F11 | F111 | M | | | | Ea | | 05/16 | 95 | 121 | | |
| YF12 | F12 | F112 | M | | | | Ea | | 05/16 | 107 | 124 | | |
| YF13 | F13 | F113 | F | | Ea | 05/02-16 | Ea | | 05/16 | 116 | 137 | | |
| YF14 | F14 | F114 | F | | WS | 05/09-17 | WS | | 05/17 | 113 | 138 | | |
| YF15 | F15 | F115 | F | <04/21 | Tr | 05/09-18 | Tr | | 05/18 | 123 | 131 | Y015 | |
| YF16 | F16 | F116 | F | <04/22 | LG | 04/23-05/19 | LG | | 05/19 | 102 | 125 | | |
| YF17 | F17 | F117 | F | | WS | 05/18-23 | WS | | 05/23 | 97 | 123 | | |
| YF18 | F18 | F118 | F | | WS | 05/18-23 | WS | | 05/23 | 84 | 113 | | YES |
| YF19 | F19 | F119 | F | <04/21 | Tr | 05/19-24 | Tr | | 05/24 | 101 | 127 | | |
| YF20 | F20 | F120 | M | | Ea | 05/21-25 | Ea | | 05/25 | 98 | 119 | | |
| YF21 | F21 | F121 | F | | Ea | 05/26 | Ea | | 05/26 | 104 | 129 | | |
| YF22 | F22 | F122 | F | <04/22 | Gi | | Gi | | 05/27 | 96 | 127 | | |
| YF23 | F23 | F123 | F | | Ea | 05/27 | Ea | | 05/27 | 126 | 136 | | |
| YF24 | F24 | F124 | M | | Ea | 05/27 | Ea | | 05/27 | 97 | 114 | | |
| YF25 | F25 | F125 | F | | Ea | 05/27 | Ea | | 05/27 | 110 | 125 | | |
| YF26 | F26 | F126 | M | | Ea | 05/28-30 | Ea | | 05/30 | 121 | 130 | | |
| YF27 | F27 | F127 | M | | Ea | 08-30 | Ea | | 05/30 | 125 | 131 | | |
| YF28 | F28 | F128 | M | | Gi | 05/20-06/01 | Gi | | 06/01 | 104 | 124 | | |
| YF29 | F29 | F129 | M | | Ea | 05/29-06/01 | Ea | | 06/01 | 119 | 132 | | |

Table 6.--Continued.

| ID NO. | Tag No.[a] L | Tag No.[a] R | | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Rehab[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YF30 | F30 | F130 | M | | WS | 06/02 | WS | | 06/02 | 112 | 128 | | |
| YF31 | F31 | F131 | F | | | | | | 06/06 | 90 | 123 | | |
| YF32 | F32 | F132 | F | | | | Ro | | 06/08 | 89 | 115 | | YES |
| YF33 | F33 | F133 | M | | | | | | 06/08 | 104 | 131 | | |
| YF34 | F34 | F134 | F | | | | Ro | | 06/08 | 94 | 127 | | |
| YF35 | F35 | F135 | M | | | | | | 06/08 | 91 | 117 | | |
| YF36 | F136 | F36 | F | | | | | | 06/08 | 85 | 111 | | YES |
| YF37 | F37 | F137 | M | | Ea | 06/05-10 | Ea | | 06/08 | 108 | 126 | | |
| YF38 | F38 | F138 | F | | Ea | 06/05-10 | Ea | | 06/10 | 92 | 120 | | |
| YF39 | F39 | F139 | M | | WS | 06/03-11 | WS | | 06/11 | 109 | 133 | | |
| YF40 | F40 | F140 | M | | WS | 06/03-11 | WS | | 06/11 | 95 | 121 | | |
| YF41 | F41 | F141 | F | | WS | 06/03-11 | WS | | 06/11 | 110 | 130 | | |
| YF42 | F42 | F142 | M | | | | | | 06/12 | 71 | 111 | | |
| YF43 | F43 | F143 | M | <05/19 | Gi | 06/02-12 | Gi | | 06/12 | 97 | 110 | Y558 | |
| YF44 | F44 | F144 | M | | Ea | 06/11-12 | Ea | | 06/12 | 90 | 120 | | |
| YF45 | F45 | F145 | F | | WS | 06/03-13 | WS | | 06/13 | 105 | 119 | | |
| YF46 | F46 | F146 | M | | WS | 06/03-13 | WS | | 06/13 | 105 | 123 | | |
| YF47 | F47 | F147 | F | 04/22-23 | Tr | 06/03-13 | Tr | 41-52 | 06/13 | 117 | 129 | Y539 | |
| YF48 | F48 | F148 | F | 04/24-05/03 | Tr | 06/03-13 | Tr | 31-50 | 06/13 | 86 | 112 | Y589 | YES |
| YF49 | F49 | F149 | F | | WS | 06/14-18 | WS | | 06/18 | 92 | 122 | | |
| YF50 | F50 | F150 | M | | Ea | 06/13-18 | Ea | | 06/18 | 106 | 120 | | |
| YF51 | F51 | F151 | F | | Ea | 06/13-19 | Ea | | 06/19 | 94 | 121 | | |
| YF52 | F52 | F152 | F | | Ea | 06/13-19 | Ea | | 06/21 | 111 | 150 | | |
| YF53 | F53 | F153 | F | | Ea | 06/19-21 | Ea | | 06/21 | 102 | 123 | | |
| YF54 | F54 | F154 | M | | Ea | 06/19-21 | Ea | | 06/21 | 111 | 130 | | |
| YF55 | F55 | F155 | F | | Ea | 06/19-21 | Ea | | 06/21 | 105 | 121 | | |
| YF56 | F56 | F156 | M | | WS | 06/14-21 | WS | | 06/21 | 97 | 120 | | |
| YF57 | F57 | F157 | M | | WS | 06/14-21 | WS | | 06/21 | 99 | 127 | | |
| YF58 | F58 | F158 | F | | WS | 06/14-21 | WS | | 06/21 | 97 | 127 | | |
| YF59 | F59 | F159 | M | | WS | 06/22-25 | WS | | 06/25 | 116 | 139 | | |

Table 6.--Continued.

| ID NO. | Tag No.[a] L | Tag No.[a] R | | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Rehab[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YF60 | F60 | F160 | F | | WS | 06/22-25 | WS | | 06/25 | 110 | 127 | | |
| YF61 | F61 | F161 | M | | WS | 06/22-25 | WS | | 06/25 | 100 | 121 | | |
| YF62 | F62 | F162 | F | 05/17-18 | Ea | 06/22-28 | Ea | 35-42 | 06/28 | 108 | 130 | Y526 | |
| YF63 | F63 | F163 | F | | Ea | 06/22-28 | Ea | | 06/28 | 119 | 148 | | |
| YF64 | F64 | F164 | M | | Ea | 06/22-28 | Ea | | 06/28 | 116 | 131 | | |
| YF65 | F65 | F165 | M | | Ea | 06/22-28 | Ea | | 06/28 | 121 | 136 | | |
| YF66 | F66 | F166 | F | | WS | 07/03-10 | WS | | 07/10 | 95 | 120 | | |
| YF67 | F67 | F167 | M | | | | | | 07/10 | 73 | 107 | | |
| YF68 | F68 | F168 | F | | | | | | 07/11 | 81 | 115 | | |
| YF69 | F69 | F169 | F | 05/20-27 | Gi | 07/01-11 | Gi | 35-52 | 07/11 | 105 | 132 | | |
| YF70 | F70 | F170 | M | | | | | | 07/14 | 102 | 132 | | |
| YF71 | F71 | F171 | M | | | | | | 07/14 | 115 | 140 | | |
| YF72 | F72 | F172 | F | | | | | | 07/14 | 98 | 127 | | |
| YF73 | F73 | F173 | F | | | | | | 07/14 | 100 | 134 | | |
| YF74 | F74 | F174 | M | | | | | | 07/14 | 96 | 122 | | |
| YF75 | F75 | F175 | F | | | | | | 07/14 | 119 | 150 | | |
| YF76 | F76 | F176 | M | | Ea | 07/07-14 | Ea | | 07/14 | 98 | 116 | | |
| YF77 | F77 | F177 | M | | Ea | 07/07-14 | Ea | | 07/14 | 112 | 124 | | |
| YF78 | F78 | F178 | M | | Ea | 07/07-14 | Ea | | 07/14 | 115 | 129 | | |
| YF79 | F79 | F179 | F | | Ea | 07/07-14 | Ea | | 07/14 | 106 | 125 | | |
| YF80 | F80 | F180 | M | 05/27-28 | Tr | 07/08-10 | Tr | 41-44 | 07/15 | 108 | 129 | Y584 | |
| YF81 | F81 | F181 | M | | WS | 07/11-15 | WS | | 07/15 | 91 | 115 | | |
| YF82 | F82 | F182 | M | 06/11 | WS | 07/11-15 | WS | 30-34 | 07/15 | 115 | 132 | | |
| YF83 | F83 | F183 | M | | Ea | 07/12-20 | Ea | | 07/20 | 116 | 140 | | |
| YF84 | F84 | F184 | F | | Ea | 07/12-20 | Ea | | 07/20 | 116 | 139 | | |
| YF85 | F85 | F185 | F | | | | | | 07/20 | 80 | 116 | | |
| YF86 | F86 | F186 | F | 05/31-06/01 | Ea | 07/12-14 | Ea | 41-44 | 07/23 | 118 | 133 | Y286 | |
| YF87 | F87 | F187 | M | | Ea | 07/12-23 | Ea | | 07/23 | 110 | 128 | | |
| YF88 | F88 | F188 | M | | WS | 07/16-25 | WS | | 07/25 | 102 | 120 | | |
| YF89 | F89 | F189 | M | | | | | | 07/25 | 89 | 124 | | |

Table 6.--Continued.

| ID NO. | Tag No.[a] L | Tag No.[a] R | | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Mother Rehab[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YF90 | F90 | F190 | F | | WS | 07/16-25 | WS | | 07/25 | 117 | 137 | | |
| YF91 | F91 | F191 | F | | | | | | 08/03 | 114 | 128 | | |
| YF92 | F92 | F192 | F | | | | | | 08/03 | 93 | 118 | | |
| YF93 | F93 | F193 | M | | | | | | 08/03 | 104 | 148 | | |
| YF94 | F94 | F194 | M | | WS | 07/16-25 | WS | | 08/05 | 78 | 113 | | |
| YF95 | F95 | F195 | M | | | | | | 08/17 | 104 | 117 | | |
| YF96 | F196 | F96 | F | | | | | | 08/16 | 109 | 131 | | |
| YF97 | F197 | F97 | M | | | | | | 08/16 | 100 | 123 | | |
| YF98 | F198 | F98 | F | | | | | | 08/16 | 117 | 140 | | |
| YF99 | F99 | F199 | F | | | | | | 08/17 | 108 | 128 | | |
| Y549 | F200 | F201 | M | | | | | | 08/17 | 104 | 131 | | |
| Y550 | F202 | F205 | M | | | | | | 08/19 | 85 | 125 | | |
| Y503 | F203 | F204 | M | | | | | | 08/19 | 93 | 110 | | |
| Y504 | F206 | F207 | F | | | | | | 08/20 | 118 | 129 | | |
| Y505 | F208 | F209 | F | | WS | 08/11-19 | WS | | 3/27/89 | 68 | 110 | | YES |
| Y506 | F210 | F211 | M | | | | | | 08/24 | 100 | 133 | | |
| Y507 | F212 | F213 | F | | | | | | 08/24 | 111 | 134 | | |
| Y508 | F214 | F215 | F | | | | | | 08/24 | 122 | 142 | | |
| Y509 | F216 | F217 | F | | | <08/24 | | | 08/24 | 82 | 117 | | |
| Y510 | F218 | F219 | F | | | <08/24 | | | 08/24 | 111 | 139 | | |
| Y511 | F220 | F221 | F | | | <08/24 | | | 08/24 | 110 | 134 | | |
| Y512 | F222 | F223 | M | | | <08/24 | | | 08/24 | | | | |
| Y513 | F224 | F226 | F | | | <08/24 | | | 08/24 | | | | |
| Y514 | F227 | F228 | F | | Gi | 08/08-25 | Gi | | 08/25 | 120 | 130 | | |
| YFN1 | | | U | 08/17-30 | WS | >08/30 | | | | | | | |
| YFN2 | | | U | 07/24-25 | WS | >08/30 | | | | | | | |
| YFN3 | | | U | 07/24-25 | WS | >08/30 | | | | | | | |
| YFN4 | | | M | 07/24-25 | WS | >08/30 | | | | | | | |
| YFN5 | | | U | 07/24-08/14 | Ea | >08/30 | | | | | | | |
| YFU1 | | | U | | | <08/30 | WS | | | | | | |

Table 6.--Continued.

| ID NO. | Tag No.[a] L | Tag No.[a] R | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Rehab[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YFU2 | | | U | | <08/30 | WS | | | | | | |
| YFU3 | | | U | | <08/30 | WS | | | | | | |
| YFU4 | | | U | | <08/30 | Ea | | | | | | |
| YFP1 | | | U >08/30 | WS | | | | | | | | |
| YFX1 | | | U 05/28-29 | WS | 05/29[f] | | | | | | Y206 | |
| YFX2 | | | U <11/17 | Te | 11/17[f] | | | | | | | |
| YFX3 | | | U <12/19 | Te | 12/19[f] | | | | | | | |

[a]L = left; R = right.
[b]Dates are either exact; i.e., 04/21 or ranges: i.e., 04/21-04/23 or before and after; i.e., <08/24 or >08/30 (field observations ended before weaning).
[c]Islet abbreviations: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Gi = Gin, LG = Little Gin, and Ro = Round.
[d]Measurement abbreviations: AG = axillary girth, SL = standard length
[e]Rehab indicates the seals collected and transported to Oahu for rehabilitation and released at Kure atoll.
[f]Found dead on this date.

Table 7.--Temple-tagged seals sighted in 1988 and 1989.

| Year | Weaned pups | Age (years) | | | | |
|---|---|---|---|---|---|---|
| | | One | Two | Three | Four | Five |
| **1988** | 114 | 98 | 77 | 69[a] | 63[b] | |
| **1989** | 101 | 78 | 88 | 69[a] | 63[a] | 60[b] |

[a]Includes 1 seal born on Laysan Island.
[b]Includes 2 seals born on Laysan Island.

Table 8.--Summary of pups born in 1989 (M = male, F = female, and U = unknown).

| ID NO. | Tag No.[a] L | Tag No.[a] R | | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Measurement[d] (cm) Tag date | AG | SL | Mother ID | Rehab?[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YU00 | U00 | U100 | F | <02/07 | Ea | 02/15-03/30 | Ea | | 03/30 | 80 | 111 | E00-89 | |
| YU01 | U01 | U101 | M | <03/30 | Ea | 03/31-04/10 | Ea | | 04/11 | 90 | 130[f] | E01-89 | |
| YU02 | U02 | U102 | M | <04/01 | WS | 04/17-25 | WS | | 04/25 | 94 | 118 | T85F | |
| YU03 | U03 | U103 | F | <03/30 | Ea | 04/30 | Ea | | 04/28 | 87 | | Y610 | YES |
| YU04 | U04 | U104 | F | <04/01 | WS | 04/26-05/05 | WS | | 05/05 | 105 | 122 | | |
| YU05 | U05 | U105 | M | <03/30 | Ea | 04/28 | Ea | | 05/11 | 102 | 129 | Y572 | |
| YU06 | U06 | U106 | F | | WS | 04/26-05/18 | WS | | 05/18 | 120 | 139 | | |
| YU07 | U07 | U107 | F | | Ea | 05/18-20 | Ea | | 05/22 | 95 | 122 | | |
| YU08 | U08 | U108 | M | <04/11 | LG | 05/05-11 | LG | | 05/24 | 104 | 117 | | |
| YU09 | U09 | U109 | F | | Ea | 05/12-20 | Ea | | 05/24 | 120 | 132 | | |
| YU10 | U10 | U110 | M | <04/11 | LG | 05/05-11 | LG | | 05/29 | 106 | 121 | | |
| YU11 | U11 | U111 | F | | Ea | 05/21-29 | Ea | | 05/29 | 118 | 135 | | |
| YU12 | U12 | U112 | M | | Ea | 05/21-29 | Ea | | 05/29 | 108 | 129 | | |
| YU13 | U13 | U113 | F | | WS | 05/19-30 | WS | | 06/04 | 108 | 123 | | |
| YU14 | U14 | U114 | M | | WS | 05/19-30 | WS | | 06/04 | 103 | 119 | | |
| YU15 | U15 | U115 | M | | Ea | 05/21-06/02 | Ea | | 06/05 | 135 | 138 | | |
| YU16 | U16 | U116 | F | 04/29 | Ea | 06/03 | Ea | 35 | 06/05 | 103 | 119 | | |
| YU17 | U17 | U117 | F | 04/14-05/05 | Tr | 05/31-06/07 | Tr | 26-54 | 06/11 | 92 | 118 | | |
| YU18 | U18 | U118 | M | 04/30 | Ea | 06/06 | Ea | 37 | 06/11 | 104 | 120 | | |
| YU19 | U19 | U119 | M | | WS | 05/19-06/11 | WS | | 06/11 | 108 | 125 | | |
| YU20 | U20 | U120 | F | | WS | 05/19-06/11 | WS | | 06/11 | 102 | 127 | | |
| YU21 | U21 | U121 | M | | WS | 05/19-06/11 | WS | | 06/11 | 105 | 123 | | |
| YU22 | U22 | U122 | M | | WS | 05/31-06/04 | WS | | 06/11 | 84 | 116 | | |
| YU23 | U23 | F123 | F | | WS | 05/19-06/11 | WS | | 06/11 | 123 | 136 | | |
| YU24 | U24 | U124 | M | 04/20 | Te | 05/27 | Te | 37 | 06/12 | 90 | 117 | | |
| YU25 | U25 | U125 | M | 05/01 | Ea | 06/12 | Ea | 42 | 06/14 | 103 | 127 | | |
| YU26 | U26 | U200 | M | 04/28 | Ea | 05/31 | Ea | 33 | 06/14 | 84 | 117 | | |
| YU27 | U27 | U127 | F | 04/27 | Ea | 06/14 | Ea | 48 | 06/14 | 123 | 138 | | |
| YU28 | U28 | U128 | F | <04/22 | Ea | 05/26 | Ea | | 06/17 | 105 | 135 | | |
| YU29 | U29 | U129 | F | | Ea | 06/03-14 | Ea | | 06/17 | 98 | 124 | | |

Table 8.--Continued.

| ID NO. | Tag No.[a] L | Tag No.[a] R | | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Rehab?[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YU30 | U30 | U130 | F | | WS | 05/19-06/11 | WS | | 06/25 | 102 | 138 | | |
| YU31 | U31 | F131 | M | 04/18-24 | LG | 05/12-29 | LG | 18-41 | 06/26 | 106 | 136[g] | Y555 | |
| YU32 | U32 | U132 | F | 05/22 | Ea | 06/22-07/04 | Ea | 31-43 | 06/26 | 103 | 131 | Y147 | |
| YU33 | U33 | U133 | M | 04/23-30 | Ea | 06/19 | Ea | 50-57 | 06/26 | 113 | 134 | | |
| YU34 | U34 | U134 | M | <04/16 | Tr | 05/19-30 | Tr | | 06/27 | 95 | 115 | Y623 | |
| YU35 | U35 | U135 | M | | WS | 06/16-27 | WS | | 06/27 | 106 | 119 | | |
| YU36 | U36 | U136 | M | | WS | 06/16-27 | WS | | 06/27 | 118 | 129 | | |
| YU37 | U37 | U137 | M | | WS | 06/16-27 | WS | | 06/27 | 102 | 124 | | |
| YU38 | U38 | U138 | M | | Ea | 06/03-28 | Ea | | 06/28 | 91 | 120 | | |
| YU39 | U39 | U139 | M | | Ea | 06/03-28 | Ea | | 06/28 | 95 | 129 | | |
| YU40 | U40 | U140 | F | 05/05-30 | Tr | 06/26-27 | Tr | 27-53 | 06/28 | 80 | 108 | Y264 | YES |
| YU41 | U41 | U141 | M | | | | | | 07/04 | 78 | 109 | | |
| YU42 | U42 | U142 | M | 05/06 | Ea | 06/18-20 | Ea | 43-45 | 07/04 | 113 | 132 | Y266 | |
| YU43 | U43 | U143 | F | 05/13 | Ea | 06/17 | Ea | 35 | 07/04 | 106 | 130 | Y272 | |
| YU44 | U44 | U144 | M | | Tr | 07/06-07 | Tr | | 07/07 | 106 | 131 | | |
| YU45 | U45 | U145 | F | | WS | 06/16-27 | WS | | 07/07 | 110 | 129 | | |
| YU46 | U46 | U146 | M | | WS | 06/16-27 | WS | | 07/07 | 112 | 127 | | |
| YU47 | U47 | U147 | M | 05/12-29 | LG | 06/27-07/09 | LG | 29-58 | 07/09 | 103 | 134 | Y022 | |
| YU48 | U48 | U148 | F | 05/12-29 | Gi | 06/27-07/09 | | 29-58 | 07/09 | 83 | 124 | G02-89 | YES |
| YU49 | U49 | U149 | F | | WS | 06/16-27 | WS | | 07/10 | 103 | 130 | | |
| YU50 | U50 | U150 | M | | Ea | 06/15-07/04 | Ea | | 07/15 | 102 | 118 | | |
| YU51 | U51 | U151 | M | 06/01 | Ea | 06/15-07/04 | Ea | 14-33 | 07/16 | 95 | 115 | | |
| YU52 | U52 | U152 | M | | Ea | 06/15-07/04 | Ea | | 07/16 | 114 | 130 | | |
| YU53 | U53 | U153 | M | | | | | | 07/19 | | 120 | | |
| YU54 | U54 | U154 | M | | | | | | 07/19 | 80 | 122 | | |
| YU55 | U55 | U155 | F | | | | | | 07/19 | 104 | 131 | | |
| YU56 | U56 | U156 | F | | | | | | 07/19 | 88 | 127 | | NO |
| YU57 | U57 | U157 | M | | | | | | 07/19 | 97 | 135 | | |
| YU58 | U58 | U158 | F | | | | | | 07/19 | 110 | 143 | | |
| YU59 | U59 | U159 | F | | | | | | 07/19 | 99 | 125 | | |

Table 8.--Continued.

| ID NO. | Tag No.[a] L | Tag No.[a] R | | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Rehab?[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YU60 | U60 | U160 | M | 05/13 | Ea | 06/18-07/04 | Ea | 36-52 | 07/19 | 96 | 125 | E27-89 | |
| YU61 | U61 | U161 | M | 05/31-06/11 | Tr | 07/11-20 | Tr | 30-50 | 07/20 | 84 | 109 | T04-89 | |
| YU62 | U62 | U162 | M | | WS | 06/28-07/07 | WS | | 07/20 | 87 | 123 | | |
| YU63 | U63 | U163 | F | | WS | 06/28-07/07 | WS | | 07/20 | 97 | 122 | | |
| YU64 | U64 | U164 | M | | WS | 06/28-07/07 | Ea | | 07/20 | 108 | 122 | | |
| YU65 | U65 | U165 | M | | Ea | 07/05-25 | Ea | | 07/25 | 110 | 128 | | |
| YU66 | U66 | U166 | F | | Ea | 07/05-25 | Ea | | 07/25 | 99 | 124 | | |
| YU67 | U67 | U167 | F | | Ea | 07/05-25 | Ea | | 07/25 | 97 | 124 | | |
| YU68 | U68 | U168 | M | 05/22 | Ea | 07/05-09 | Ea | 44-48 | 07/25 | 116 | 145 | Y523 | |
| YU69 | U69 | U169 | M | | Ea | 07/05-25 | Ea | | 07/25 | 103 | 126 | | |
| YU70 | U70 | U170 | F | | Ea | 07/05-25 | Ea | | 07/25 | 100 | 117 | | |
| YU71 | U71 | U171 | F | | Ea | 06/28-07/07 | WS | | 07/27 | 114 | 137 | | |
| YU72 | U72 | U172 | F | | | | | | 07/31 | 106 | 129 | | |
| YU73 | U73 | U173 | F | | | | | | 07/31 | 97 | 125 | | |
| YU74 | U74 | U174 | F | | Ea | 07/05-31 | Ea | | 07/31 | 126 | 144 | | |
| YU75 | U75 | U175 | F | | Ea | 07/05-31 | Ea | | 08/03 | 112 | 131 | | |
| YU76 | U76 | U176 | F | 06/28-07/10 | Sh | 07/28-08/04 | Sh | 18-37 | 08/04 | 84 | 110 | Y150 | NO |
| YU77 | U77 | U177 | M | | Ea | 07/05-08/06 | Ea | | 08/06 | 102 | 131 | | |
| YU78 | U78 | U178 | F | | Ea | 07/05-08/06 | Ea | | 08/06 | 88 | 131 | | |
| YU79 | U79 | U179 | M | | | | | | 08/07 | 118 | 139 | | |
| YU80 | U80 | U180 | F | <04/11 | Gi | 05/12-29 | Gi | | 08/09 | 101 | 137 | Y622 | |
| YU81 | U81 | U181 | M | | Ea | 08/07-09 | Ea | | 08/09 | 97 | 116 | | |
| YU82 | U82 | U182 | M | | | | | | 08/15 | 111 | 139 | | |
| YU83 | U83 | U183 | F | | | | | | 08/15 | 123 | 140 | | |
| YU84 | U84 | U184 | F | | Ea | 08/15-17 | Ea | | 08/17 | 94 | 115 | | |
| YU85 | U85 | U185 | M | | | | | | 08/17 | 110 | 124 | | |
| YU86 | U86 | U186 | F | | | | | | 08/17 | 130 | 140 | | |
| YU87 | U87 | U187 | F | | | | | | 08/17 | 116 | 136 | | |
| YU88 | U88 | U188 | F | | | | | | 08/17 | 116 | 144 | | |
| YU89 | U89 | U189 | M | | | | | | 08/17 | 113 | 135 | | |

Table 8.--Continued.

| ID NO. | Tag No.[a] L | Tag No.[a] R | Sex | Birth Date[b] | Birth Islet[c] | Weaning Date[b] | Weaning Islet[c] | Nursing period (days) | Tag date | Measurement[d] (cm) AG | Measurement[d] (cm) SL | Mother ID | Rehab?[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YU90 | U90 | U190 | F | | | | | | 08/17 | 113 | 135 | | |
| YU91 | U91 | U191 | F | | Ea | 08/17-21 | Ea | | 08/21 | 105 | 131 | | |
| YU92 | U92 | U192 | F | | | | | | 08/22 | 117 | 139 | | |
| YU93 | U93 | U193 | F | | | | | | 08/22 | 105 | 131 | | |
| YU94 | U94 | U194 | M | | | | | | 08/23 | 110 | 128 | | |
| YU95 | U95 | U195 | F | | Ea | 08/22-25 | Ea | | 08/25 | 104 | 130 | | |
| YU96 | U96 | U196 | F | | Ea | 08/24-25 | Ea | | 08/25 | 116 | 132 | | |
| YU97 | U97 | U197 | M | | | | | | 08/28 | 88 | 127 | | |
| YU98 | U98 | U198 | F | | | | | | 08/31 | 107 | 126 | | |
| YU99 | U99 | U199 | M | 07/10-19 | Gi | 08/28-09/03 | Gi | 40-55 | 09/03 | 113 | 131 | Y466 | |
| Y515 | U204 | U203 | F | 07/20-26 | Gi | 08/28-09/03 | Gi | 33-45 | 09/03 | 120 | 140 | Y556 | |
| YUN1 | | | U | 07/26-27 | WS | >09/02 | | | | | | Y067 | |
| YUN2 | | | U | 08/18-21 | Ea | >09/03 | | | | | | Y201 | |
| YUN3 | | | U | 07/28-31 | WS | >09/02 | | | | | | Y213 | |
| YUN4 | | | U | 07/26-28 | WS | >09/02 | | | | | | Y273 | |
| YUX1 | | | F | 04/04 | Te | 04/04[h] | | | | 41 | 69 | Y009 | |
| YUX2 | | | M | 04/10 | Te | 04/10[h] | | | | 42 | 87 | Y033 | |
| YUX5 | | | U | 04/25-05/03 | LG | 05/03[h] | | | | | | Y382 | |
| YUX4 | | | U | 04/18-22 | Ea | 04/22[h] | | | | | | Y574 | |
| YUX3 | | | F | 04/12-17 | Ea | 04/17[h] | | | | | | | |
| YUXB | | | M | 06/22 | Ea | 08/10[i] | | | | 63[j] | 95 | Y530 | |
| YUX6 | | | U | 05/06-12 | WS | 05/12[h] | | | | | | W16-89 | |
| YUX7 | | | F | 05/19-20 | Te | 05/20[h] | | | | 44 | 108 | Y617 | |
| YUX8 | | | M | | WS | 07/07[i] | | | | | | | |
| YUX9 | | | U | 06/28-07/10 | Sh | 07/10-20[i] | | | | | | Y011 | |
| YUXA | | | F | 07/31 | Ea | 08/03[h] | | | | | | Y459 | |
| YUXC | | | U | 04/09-10 | Ea | 04/11[i] | | | | | | Y630 | |
| YUXD | | | U | 04/27 | Ea | 04/28[i] | | | | | | E17-89 | |
| YUXE | | | U | 04/30 | Ea | 05/02[i] | | | | | | Y063 | |
| YUXF | | | U | 11//89 | Te | 11//89[h] | | | | | | | |

Table 8.--Continued.

[a]L = left; R = right.
[b]Dates are either exact; i.e., 04/21 or ranges; i.e., 04/21-04/23 or before and after; i.e., <08/24 or >08/30 (weaned or born before or after date).
[c]Islet abbreviations: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Sh = Shark, Gi = Gin, and LG = Little Gin.
[d]Measurement abbreviations: AG = axillary girth; SL = standard length.
[e]Rehab? indicates the seals collected and transported to Oahu for rehabilitation (feeding and release at Kure Atoll).
[f]Measured to the end of the hind flippers.
[g]Curvilinear measure from nose to tip of tail.
[h]Found dead on this date.
[i]Disappeared by this date.
[j]Measured on 07/15.

Table 9.--Summary of parturition for adult females in 1988.

| ID No. | Temp. ID No. | Birth | | Wean date[a] | Lactation period (days) | Pupped last year?[c] | Inter-pup. time[d] |
|---|---|---|---|---|---|---|---|
| | | Date[a] | Islet[b] | | | | |
| Y004 | E30 | 05/28-30 | Ea | 07/01-11 | 32-44 | Y | 363 |
| Y011 | W23 | 06/01 | WS | 07/16-25 | 45-54 | Y | |
| Y014 | E19 | <05/25 | Ea | 07/06 | | Y | |
| Y015 | T01 | <04/23 | Tr | 04/24-05/18 | | U | |
| Y022 | W06 | <05/17 | WS | 06/12-14 | | Y | |
| Y030 | W17 | <05/24 | WS | 06/12-15 | | U | |
| Y033 | E13 | 05/25 | Ea | 06/20-21 | 26-27 | Y | 408 |
| Y055 | W01 | <04/27 | WS | 05/31-06/11 | | Y | |
| Y059 | W10 | <05/23 | WS | 06/12-15 | | U | |
| Y061 | W28 | 06/11 | WS | 07/11-15 | 30-34 | Y | |
| Y063 | E04 | <04/22 | Ea | 05/28-06/01 | | U | |
| Y067 | W32 | 06/29-07/01 | WS | 07/26-08/30 | 25-62 | Y | |
| Y072 | W07 | <05/17 | WS | 06/22-25 | | Y | |
| Y084 | W34 | 07/04-15 | WS | 07/26-08/30 | 11-46 | U | |
| Y128 | E43 | 07/07-11 | Ea | >07/23[e] | | Y | 374 |
| Y146 | R02 | <06/03 | Ro | >06/04 | | U | |
| Y147 | E05 | <05/26 | Ea | 05/27-06/01 | | Y | |
| Y150 | W09 | <05/23 | WS | 06/16-21 | | U | |
| Y173 | E44 | 07/07-11 | Ea | >07/23[e] | | U | |
| Y180 | E34 | 06/01 | Ea | 07/12-20 | 41-49 | Y | 378 |
| Y190 | W18 | <05/24 | WS | 06/03-11 | | U | |
| Y206 | W20 | 05/28 | WS | 05/29[f] | | U | |
| Y209 | E11 | <05/25 | Ea | 06/22-24 | | Y | |
| Y213 | W37 | 07/23-25 | WS | >08/30[e] | | Y | |
| Y218 | E39 | 06/27-28 | Ea | >07/20[e] | | Y | 371 |
| Y220 | E06 | <05/05 | Ea | 06/02-04 | | Y | |
| Y227 | W35 | 07/11-15 | WS | 06/12-15 | | Y | |
| Y229 | W13 | <05/24 | WS | 06/12-15 | | Y | |
| Y251 | E42 | 06/29-30 | Ea | >07/23[e] | | Y | 383 |
| Y253 | W04 | <04/27 | WS | 05/26-06/11 | | Y | |
| Y266 | E21 | <05/23 | Ea | 06/05/10 | | Y | |
| Y272 | E07 | <05/05 | Ea | 06/05-10 | | Y | |
| Y279 | E40 | 06/22-28 | Ea | >07/23[e] | | Y | 381 |
| Y285 | E20 | <05/25 | Ea | 06/13-18 | | U | |
| Y286 | E33 | 05/31-06/01 | Ea | 07/12-14 | 41-44 | Y | |
| Y288 | W39 | 08/17-30 | WS | >08/30[e] | | U | |
| Y458 | E12 | <05/25 | Ea | 06/19 | | Y | |
| Y459 | E45 | 07/12-14 | Ea | >07/23[e] | | Y | 365 |
| Y461 | E35 | 06/05-10 | Ea | >07/23[e] | | Y | |
| Y462 | E41 | 06/30 | Ea | >07/23[e] | | Y | 394 |
| Y463 | W30 | 06/12-15 | WS | 07/26-08/30 | 41-79 | Y | |
| Y465 | W25 | 06/06-07 | WS | 07/16-25 | 39-49 | U | |
| Y466 | G03 | 06/18-24 | Gi | 08/09-14 | 46-57 | Y | |
| Y500 | W29 | 06/11-15 | WS | 07/16-25 | 31-44 | Y | |
| Y502 | E32 | 06/01 | Ea | 07/07-11 | 36-40 | Y | 380 |
| Y516 | E01 | <04/22 | Ea | 05/06-30 | | Y | |

Table 9.--Continued.

| ID No. | Temp. ID No. | Birth | | Wean date[a] | Lactation period (days) | Pupped last year?[c] | Inter-pup. time[d] |
|---|---|---|---|---|---|---|---|
| | | Date[a] | Islet[b] | | | | |
| Y522 | E24 | <05/26 | Ea | >05/27 | | U | |
| Y523 | E23 | <05/26 | Ea | 06/11-18 | | Y | |
| Y524 | E15 | <05/25 | Ea | 06/22-24 | | Y | |
| Y526 | E09 | 05/17-18 | Ea | 06/25-28 | 38-42 | U | |
| Y528 | E29 | <05/30 | Ea | 06/29-07/11 | | Y | |
| Y529 | E22 | <05/26 | Ea | 07/07-11 | | Y | |
| Y531 | E37 | 06/13-18 | Ea | >07/23[e] | | Y | |
| Y532 | W03 | <04/27 | WS | 05/26-06/11 | | Y | |
| Y534 | E08 | 05/14-16 | Ea | 06/19 | 34-36 | Y | 394 |
| Y535 | W26 | 06/03-04 | WS | 07/16-25 | 45-52 | U | |
| Y537 | E25 | <05/26 | Ea | 06/11-18 | | Y | |
| Y539 | T03 | 04/22-23 | Tr | 06/03-13 | 41-52 | Y | |
| Y544 | E02 | <04/22 | Ea | >05/05 | | U | |
| Y545 | W27 | 06/03-11 | WS | 07/03-10 | 22-37 | Y | |
| Y546 | W15 | <05/23 | WS | 06/03-11 | | Y | |
| Y551 | W33 | 06/26-07/01 | WS | 07/25-08/30 | 24-65 | U | |
| Y553 | E36 | 06/05 | Ea | 07/11 | 36 | Y | 397 |
| Y557 | G02 | 04/23-05/27 | Gi | 07/01-11 | 35-80 | U | |
| Y558 | G01 | 04/23-06/01 | Gi | 06/02-12 | 1-51 | Y | |
| Y560 | E38 | 06/21 | Ea | >07/23[e] | | U | |
| Y563 | W31 | 06/22-25 | WS | 07/25-08/30 | 30-69 | U | |
| Y581 | W21 | <05/30 | WS | 06/03-11 | | U | |
| Y584 | T05 | <05/28 | Tr | 06/26-07/10 | | U | |
| Y589 | T04 | 04/24-05/03 | Tr | 06/03-13 | 31-50 | U | |
| Y595 | W36 | 07/23-25 | WS | >08/30[e] | | U | |
| Y603 | W19 | <05/30 | WS | 07/03-06 | | U | |
| Y607 | W14 | <05/23 | WS | 06/22-25 | | U | |
| | E10 | <05/25 | Ea | 05/27-30 | | U | |
| | E16 | <05/25 | Ea | >05/26 | | U | |
| | T02 | <05/03 | Tr | 05/04-24 | | U | |
| | W05 | <05/03 | WS | 05/04-23 | | U | |
| | W38 | 07/16-25 | WS | >08/30[e] | | U | |

[a]Dates are of observations that were either exact; i.e., 06/92 or ranges; i.e., 06/02-04 or before of after; i.e., <08/23 or >08/23.
[b]Islet abbreviations: Ea = East, WS = Whaleskate, Tr = Trig, Gi = Gin, and Ro = Round.
[c]Y = yes, N = No, and U = unknown.
[d]Interpupping time is the number of days between pupping in consecutive years. When dates are ranges the median date of birth and of weaning are used if the ranges are less than 11 days.
[e]Female still lactating on this date.
[f]Pup found dead.

Table 10.--Summary of parturition for adult females in 1989.

| ID No. | Temp. ID No. | Birth | | Wean date[a] | Lactation period (days) | Pupped last year?[c] | Inter-pup. time[d] |
|---|---|---|---|---|---|---|---|
| | | Date[a] | Islet[b] | | | | |
| Y004 | E39 | 06/17 | Ea | 07/26-29 | 39-42 | Y | 385 |
| Y009 | TN4 | 04/04 | Te | 04/04[e] | | U | |
| Y011 | SH2 | 06/28-07/10 | Sh | 07/11-18[f] | | Y | |
| Y014 | E33 | 06/02 | Ea | 07/20/25 | 48-53 | Y | |
| Y022 | LG4 | 05/12-29 | LG | 06/27-07/09 | 29-58 | Y | |
| Y027 | W07 | 04/17-25 | WS | 05/19-06/04 | 24-48 | U | |
| Y030 | W21 | 05/19-06/04 | WS | 06/28-07/07 | 24-49 | Y | |
| Y033 | TN2 | 04/10 | Te | 04/10[e] | | Y | 321 |
| Y055 | W06 | 04/24-25 | WS | 06/05-15 | 41-52 | Y | |
| Y059 | W22 | 05/19-06/04 | WS | 06/28-07/07 | 24-49 | Y | |
| Y061 | W29 | 06/14-15 | WS | 07/08-10 | 23-26 | U | 369 |
| Y063 | E20 | 04/30 | Ea | 06/03-05 | 34-36 | Y | |
| Y067 | W37 | 07/26-27 | WS | >09/02[g] | | Y | |
| Y084 | W33 | 07/02-07 | WS | 08/15-17 | 40-46 | Y | 361 |
| Y094 | R12 | 06/20-07/19 | Ro | 08/04-09 | 16-50 | U | |
| Y128 | E49 | 07/16 | Ea | 08/18-21 | 33-36 | Y | 373 |
| Y145 | R02 | <06/08 | Ro | >06/09 | | U | |
| Y146 | E25 | 05/13 | Ea | 06/18-20 | 36-38 | Y | |
| Y147 | E30 | 05/22 | Ea | 06/22-07/04 | 31-43 | Y | |
| Y150 | SH1 | 06/28-07/10 | Sh | 07/27-08/04 | 17-37 | Y | |
| Y162 | E07 | 03/31-04/11 | Ea | 05/23 | 42-53 | U | |
| Y190 | W18 | 05/13-18 | WS | 06/16-25 | 29-43 | Y | |
| Y201 | E52 | 08/18-21 | Ea | >09/03[g] | | U | |
| Y209 | E32 | 06/01 | Ea | 07/05-09 | 34-38 | Y | |
| Y213 | W38 | 07/28-31 | WS | >09/02[g] | | Y | |
| Y218 | E47 | 07/10 | Ea | 08/24-27 | 45-48 | Y | 378 |
| Y251 | E50 | 07/10-16 | Ea | 08/22-27 | 37-48 | Y | 380 |
| Y253 | W11 | 04/26-05/05 | WS | 06/05-15 | 31-50 | Y | |
| Y264 | T03 | 05/05-30 | Tr | 06/26-27 | 27-53 | U | |
| Y265 | Z75 | 04/29-05/20 | U | 05/21-07/26 | 1-88 | U | |
| Y266 | E24 | 05/06 | Ea | 06/18-20 | 43-45 | Y | |
| Y268 | E05 | 03/31-04/10 | Ea | 05/22 | 42-52 | U | |
| Y272 | E26 | 05/13 | Ea | 06/17 | 36 | Y | |
| Y273 | W36 | 07/26-07/27 | WS | >09/02[g] | | U | |
| Y279 | E45 | 07/08 | Ea | 08/14-17 | 37-40 | Y | 379 |
| Y286 | E36 | 06/06 | Ea | 07/20-25 | 44-49 | Y | 371 |
| Y287 | E28 | 05/16 | Ea | 06/18-20 | 33-35 | U | |
| Y335 | W15 | 05/06-12 | WS | 06/05-15 | 24-40 | N | |
| Y382 | LG3 | 04/25-05/04 | LG | 05/04[e] | | U | |
| Y459 | E51 | 07/31 | Ea | >08/27[g] | | Y | 384 |
| Y461 | E46 | 07/08-09 | Ea | 08/14-17 | 36-40 | Y | |
| Y462 | E43 | 07/05 | Ea | 08/07-09 | 33-35 | Y | 370 |
| Y464 | W32 | 06/20-06/25 | WS | 07/28-08/03 | 33-44 | U | |
| Y466 | G03 | 07/18-07/19 | Gi | 08/28-09/03 | 40-47 | Y | 395 |
| Y502 | E34 | 06/03 | Ea | 07/20-25 | 47-52 | Y | 367 |
| Y516 | E08 | 04/08-10 | Ea | 04/12-24[f] | | Y | |

Table 10.--Continued.

| ID No. | Temp. ID No. | Birth | | Wean date[a] | Lactation period (days) | Pupped last year?[c] | Inter-pup. time[d] |
|---|---|---|---|---|---|---|---|
| | | Date[a] | Islet[b] | | | | |
| Y517 | E09 | 04/01-17 | Ea | 05/22 | 35-51 | U | |
| Y518 | E12 | 04/18-22 | Ea | 05/28-29 | 36-41 | U | |
| Y519 | E15 | 04/25-27 | Ea | 06/04 | 38-40 | U | |
| Y520 | E16 | 04/25-27 | Ea | 06/02 | 36-38 | U | |
| Y521 | E22 | 05/01 | Ea | 06/07-14 | 37-44 | U | |
| Y522 | E23 | 05/05 | Ea | 06/07-14 | 33-40 | Y | |
| Y523 | E29 | 05/22 | Ea | 07/05-09 | 44-48 | Y | |
| Y524 | E31 | 06/01 | Ea | 07/05-09 | 32-36 | Y | 381 |
| Y527 | E37 | 06/07 | Ea | 07/10-16 | 33-39 | U | |
| Y528 | E38 | 06/12 | WS | 07/10-19 | 28-37 | Y | |
| Y529 | E41 | 06/19 | Ea | 07/20-25 | 31-36 | Y | |
| Y530 | E42 | 06/22 | Ea | 07/27-08/06 | 35-45 | U | |
| Y531 | E44 | 07/05-08 | Ea | 08/22-08/23 | 45-49 | Y | |
| Y532 | W13 | 04/23-05/05 | WS | 06/05-15 | 31-53 | Y | |
| Y534 | W23 | 05/19-06/04 | WS | 07/08-09 | 34-51 | Y | |
| Y535 | W34 | 07/02-07 | WS | 08/11-14 | 35-43 | Y | |
| Y536 | R01 | 04/26-06/08 | Ro | 06/09-07/18 | 1-83 | U | |
| Y537 | R05 | 04/26-06/08 | Ro | 07/19-08/17 | 41-103 | Y | |
| Y538 | R15 | <08/17 | Ro | 08/28-08/31 | | U | |
| Y551 | W35 | 07/08-10 | WS | 08/18-08/22 | 39-45 | Y | 376 |
| Y552 | W39 | 08/08-14 | WS | >09/03 | | U | |
| Y554 | W20 | 05/13-18 | WS | 06/26-27 | 39-45 | U | |
| Y555 | LG2 | 04/17-24 | LG | 05/12-29 | 18-42 | U | |
| Y556 | G04 | 07/25-26 | Gi | 08/28-09/03 | 33-40 | U | |
| Y559 | LG1 | <04/11 | LG | 05/05-11 | | U | |
| Y560 | E48 | 07/15 | Ea | 08/18-21 | 34-37 | Y | 389 |
| Y572 | E03 | <03/30 | Ea | >04/28 | | U | |
| Y573 | E10 | 04/12-17 | Ea | 05/12-17 | 25-35 | U | |
| Y574 | E11 | 04/20-22 | Ea | 04/22[e] | | U | |
| Y575 | E18 | 04/28 | Ea | 05/30 | 32 | U | |
| Y576 | E19 | 04/29 | Ea | >05/02[f] | | U | |
| Y577 | W01 | <04/01 | WS | 04/26-05/05 | | U | |
| Y578 | W04 | 04/11-16 | WS | 05/19-06/04 | 35-54 | U | |
| Y579 | W08 | 04/26-05/05 | WS | 05/19-06/04 | 14-41 | U | |
| Y580 | W12 | 04/26-05/05 | WS | 06/05-06/15 | 31-50 | U | |
| Y581 | W17 | 05/13-05/18 | WS | 06/16-06/25 | 34-43 | Y | |
| Y582 | TN1 | 04/20 | Te | 05/27 | 37 | U | |
| Y583 | T02 | 04/26-05/05 | Tr | 05/31-06/07 | 26-42 | U | |
| Y584 | R04 | 04/26-06/08 | Ro | 06/09-07/18 | 1-83 | Y | |
| Y585 | R06 | 04/13-06/08 | Ro | 06/09-07/22 | 1-100 | U | |
| Y587 | Z05 | 04/14-06/06 | U | 04/14-06/06 | | U | |
| Y610 | E02 | <03/30 | Ea | >04/28 | | U | |
| Y611 | W28 | 06/05-15 | WS | 07/21-27 | 36-52 | U | |
| Y612 | W09 | 04/26-05/05 | WS | 06/05-15 | 31-45 | U | |
| Y614 | E14 | 04/23-27 | Ea | 06/04 | 38-42 | U | |
| Y616 | W25 | 06/02-04 | WS | 07/11-20 | 37-48 | U | |

Table 10.--Continued.

| ID No. | Temp. ID No. | Birth Date[a] | Birth Islet[b] | Wean date[a] | Lactation period (days) | Pupped last year?[c] | Inter-pup. time[d] |
|---|---|---|---|---|---|---|---|
| Y617 | TN3 | 05/11 | Te | 05/19[e] | | U | |
| Y620 | W10 | 04/26-05/05 | WS | 06/05-15 | 31-50 | U | |
| Y622 | G01 | <04/11 | Gi | 05/12-29 | | U | |
| Y623 | T01 | <04/16 | Tr | 04/26-05/05 | | U | |
| Y624 | W05 | 04/17-25 | WS | 05/19-06/04 | 24-48 | U | |
| Y625 | W14 | 05/06-12 | WS | 06/16-06/25 | 35-50 | U | |
| Y630 | E06 | 03/31-04/10 | Ea | 04/11-04/17[f] | | U | |
| Y636 | E13 | 04/18-22 | Ea | 05/27 | 35-39 | U | |
| Y637 | E40 | 06/17 | Ea | 07/19/25 | 32-38 | U | |
| T85F | W02 | <04/01 | WS | 04/17-25 | | U | |
| | E00 | <03/30 | Ea | >03/31 | | U | |
| | E01 | <03/30 | Ea | 03/31-04/10 | | U | |
| | E04 | 03/29-30 | Ea | 05/20 | 51-52 | U | |
| | E17 | 04/25-27 | Ea | 04/28-29[f] | | U | |
| | E21 | 04/30 | Ea | 06/18-19 | 49-50 | U | |
| | E27 | 05/13 | Ea | 06/18-07/04 | 36-52 | U | |
| Y642 | W03 | <04/01 | WS | 04/26-05/05 | | U | |
| | W16 | 05/11-12 | WS | 05/12[e] | | U | |
| | W19 | 05/15-18 | WS | 06/16-25 | 29-41 | U | |
| | W24 | 06/02-04 | WS | 06/28-07/07 | 24-35 | U | |
| Y568 | W26 | 06/05-10 | WS | 07/11-20 | 31-45 | U | |
| | W27 | 06/11-15 | WS | 07/11-20 | 26-39 | U | |
| | W30 | 06/12-15 | WS | 07/21-27 | 36-45 | U | |
| | G02 | 05/12-29 | Gi | 06/27-07/09 | 29-58 | U | |
| | T04 | 05/30-06/11 | Tr | 07/11-20 | 30-51 | U | |
| | R03 | 04/26-06/08 | Ro | 06/09-07/18 | 1-83 | U | |
| | R07 | 04/26-06/08 | Ro | 06/09-07/18 | 1-83 | U | |
| | R08 | 04/26-06/08 | Ro | 06/09-07/18 | 1-83 | U | |
| | R09 | 04/26-06/08 | Ro | 06/09-07/18 | 1-83 | U | |
| | R10 | 04/26-06/08 | Ro | 06/09-07/18 | 1-83 | U | |
| | R11 | <07/19 | Ro | >07/20 | | U | |
| | R13 | <07/31 | Ro | >08/01 | | U | |
| | R14 | <07/31 | Ro | >08/01 | | U | |

[a]Dates are of observations that were either exact; i.e., 06/02 or ranges; i.e., 06/02-04 or before or after; i.e., <08/23 or >08/23.
[b]Islet abbreviations: Ea = East, WS = Whaleskate, Tr = Trig, Gi = Gin, Ro = Round, and U = unknown.
[c]Y = yes, N = No, and U = unknown.
[d]Interpupping time is the number of days between pupping in consecutive years. When dates are ranges the median date of birth and of weaning are used if the ranges are less than 11 days.
[e]Pup found dead.
[f]Pup had disappeared during this time.
[g]Female still lactating on this date.

Table 11.--Cohort survival, 1984-1988.

| Year tagged | Sex[a] | No. tagged[b] | Number/% surviving to year X[c] | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1984 | F | 43 | 36/84 | 36/84 | 34/79 | 31/72 | 29/67 |
| | M | 49 | 42/86 | 38/78 | 33/67 | 31/63 | 30/61 |
| 1985 | F | 38 | 35/92 | 33/87 | 32/84 | 30/79 | |
| | M | 47 | 45/96 | 39/83 | 36/77 | 32/68 | |
| 1986 | F | 48 | 43/90 | 40/83 | 35/73 | | |
| | M | 52 | 45/87 | 39/75 | 33/63 | | |
| 1987 | F | 51 | 47/92 | 43/84 | | | |
| | M | 55 | 51/93 | 45/82 | | | |
| 1988 | F | 62 | 40/65 | | | | |
| | M | 52 | 38/73 | | | | |

[a]Sex: F = female; M = male.
[b]Prematurely weaned female pups tagged and collected for rehabilitation are included in the "Number tagged" but are considered dead in subsequent years. Number of pups collected 1984-88: 3, 2, 3, 0, 8.
[c]Number surviving includes seals not seen in 1988 or 1989 but resighted in 1990 or 1991.

Table 12.--Seals retagged with yellow Temple Tags at French Frigate Shoals in 1988.

| | | Left tag | | Right tag | | |
|---|---|---|---|---|---|---|
| ID No. | Sex[a] | New | Old | New | Old | Date |
| Y418 | F | - | K35 | K102 | K35 | 07/24 |
| YL18 | M | - | L18 | L518 | L118 | 07/24 |
| YL48 | F | L516 | L48 | L515 | L148 | 07/15 |
| YL51 | F | - | L507 | | - | 05/23 |

[a]Sex: F = female; M = male

Table 13.--Seals retagged with yellow Temple Tags at French Frigate Shoals in 1989.

| | | Left tag | | | Right tag | | |
|---|---|---|---|---|---|---|---|
| ID No. | Sex[a] | New | Old | Old | New | Old | Date |
| Y376 | M | - | T89 | | T100 | - | 08/16 |
| Y387 | M | K113 | K04 | | - | K04 | 09/02 |
| Y393 | F | - | K10 | | K99 | - | 08/22 |
| Y408 | M | K111 | K25 | | - | K25 | 08/26 |
| Y413 | M | - | K30 | | K105 | K30 | 04/06 |
| Y430 | F | K88 | - | | - | K48 | 08/16 |
| Y434 | M | - | K52 | K104 | K112 | K52 | 08/30 |
| Y435 | F | K110 | K53 | | - | K53 | 08/26 |
| Y448 | M | K96 | K66 | | - | K66 | 08/22 |
| Y475 | F | - | K77 | | K87 | K77 | 08/11 |
| YL00 | M | L504 | L00 | | L505 | L100 | 04/05 |
| YL02 | M | L560 | - | | L561 | L02 | 08/01 |
| YL05 | M | L562 | L05 | | L559 | L105 | 08/15 |
| YL10 | F | L573 | L10 | | L571 | L110 | 08/25 |
| YL13 | M | - | L13 | | L568 | L113 | 08/22 |
| YL19 | M | L567 | - | | - | L119 | 08/17 |
| YL22 | M | - | L22 | | L563 | L122 | 08/17 |
| YL24 | M | L570 | L24 | | L569 | L124 | 08/22 |
| YL34 | M | L539 | L34 | | L538 | L134 | 05/15 |
| YL35 | F | L528 | L35 | | L529 | L135 | 07/19 |
| YL39 | M | L522 | L39 | | L523 | L139 | 04/21 |
| YL40 | F | - | L511 | | L575 | L140 | 08/31 |
| YL42 | M | L549 | L42 | | L548 | - | 08/05 |
| YL46 | F | L500 | L46 | | - | L508 | 07/18 |
| YL47 | M | L525 | L47 | | L524 | - | 04/07 |
| YL53 | M | L564 | L53 | | L565 | L153 | 08/17 |
| YL56 | F | L534 | L56 | | L535 | L156 | 03/30 |
| YL61 | F | L557 | - | | L556 | L161 | 07/26 |
| YL63 | M | - | L63 | | L555 | L163 | 08/09 |
| YL64 | F | L546 | L64 | | - | L164 | 05/10 |
| YL69 | F | L520 | - | | L547 | L169 | 04/15 |
| YL71 | F | L501 | L71 | | - | L171 | 04/07 |
| YL73 | F | L537 | L73 | | L536 | L173 | 07/18 |
| YL75 | F | - | L75 | | L521 | L175 | 05/14 |
| YL77 | M | L554 | L77 | | - | L177 | 07/25 |
| YL78 | F | L566 | L78 | | - | L178 | 08/17 |
| YL81 | F | L542 | L81 | | - | L181 | 07/19 |
| YL83 | M | L540 | L83 | | L541 | L183 | 05/14 |
| YL90 | F | L552 | - | | L553 | L190 | 07/25 |
| YL91 | F | L574 | - | | L572 | L785 | 08/25 |
| YL96 | M | - | L96 | | L558 | L781 | 08/11 |
| L485 | M | L526 | L448 | | L527 | L478 | 05/09 |
| L488 | F | L551 | L484 | | L550 | - | 07/25 |
| YN29 | M | N72 | - | | - | N29 | 08/12 |
| YN45 | M | N73 | - | | - | N145 | 08/12 |

Table 13.--Continued.

| ID No. | Sex[a] | Left tag | | | Right tag | | Date |
|---|---|---|---|---|---|---|---|
| | | New | Old | Old | New | Old | |
| YF12 | M | - | F12 | | F231 | - | 08/17 |
| YF80 | M | F230 | - | | F229 | F180 | 08/07 |
| YU26 | M | - | U26 | | U200 | - | 08/27 |

[a]Sex: F = female; M = male

Table 14.--Inter-island movement between French Frigate Shoals and Laysan Island in 1988 and 1989.

| ID No. | Tag No. L | Tag No. R | Tag Color | Temp. ID No. | Age Class[a] | Sex[b] | Movement from Location | Movement from Date last seen | Movement to Location | Movement to Date first seen |
|---|---|---|---|---|---|---|---|---|---|---|
| T45M | | | | 293[c] | A | M | Laysan | 04/21/88 | FFS | 05/23/88 |
| T46M | | | | 125[c] | A | M | Laysan | 03/15/88 | FFS | 09/15/88 |
| Y322 | T33 | T33 | Yellow | | S | M | FFS | 07/06/87 | Laysan | 03/07/88 |
| YL11 | L11 | L111 | Yellow | | J | M | FFS | 06/23/87 | Laysan | 03/12/88 |
| TK25 | K25 | K24 | Tan | | J | M | Laysan | 07/13/87 | FFS | 08/19/88 |
| TT08 | T08 | T07 | Tan | | S | M | Laysan | 08/02/86 | FFS | 09/15/88 |
| T85F | | | | 610[d] | A | F | Laysan | 11/09/88 | FFS | 03/29/89 |
| T85F | | | | 610 | A | F | FFS | 04/16/89 | Laysan | 05/19/89 |
| TL08 | L08 | L09 | Tan | | S | M | Laysan | 06/13/88 | FFS | 03/09/89 |
| Y156 | | | | 135[d] | A | F | Laysan | 04/14/89 | FFS | 04/26/89 |
| Y156 | | | | 135 | A | F | FFS | 04/26/89 | Laysan | 05/30/89 |
| Y296 | T07 | T07 | Yellow | | S | M | FFS | 02/06/89 | Laysan | 04/05/89 |

[a]Age class: A = adult, S = subadult, and J = juvenile.
[b]Sex: M = male; F = female.
[c]Numbers applied with hair bleach at Laysan Island in 1988.
[d]Numbers applied with hair bleach at Laysan Island in 1989.

Table 15.--Entanglement in debris at French Frigate Shoals in 1988 and 1989.

| Field No. | Date found | Age class[a] | Sex[b] | ID No. | Islet[c] | Type of debris | Part of body entangled | Extent of restriction[d] |
|---|---|---|---|---|---|---|---|---|
| 01 | 06/13/88 | J | F | | Sh | plastic basket | neck | none |
| 01 | 01/15/89 | J | M | YF59 | Te | net | neck, head | partial |
| 02 | 04/10/89 | W | M | YU01 | Ea | wire | neck | none |
| 03 | 04/12/89 | A | M | | Te | band | mid-torso | none |
| 04 | 05/08/89 | A | M | | Te | rope | mid-torso | none |
| 05 | 06/11/89 | A | F | | WS | rope | neck | none |
| 07 | 07/05/89 | S | U | | Te | band | neck | none |

[a]Age class: A = adult, S = subadult, J = juvenile, and W = weaned pup.
[b]Sex: M = male; F = female.
[c]Islet: Sh = Shark, Te = Tern, Ea = East, and WS = Whaleskate.
[d]All materials were removed.

Table 16.--Injuries from April 12-December 9, 1988.

| Field No. | Islet[a] | Date | Age class[b] | Sex[c] | ID No. | Injury type[d] | Location on body[e] | Dimension(cm.)[f] Depth | Dimension(cm.)[f] lxw/diam | Condition[g] | Cause[h] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | WS | 05/03 | J | U | | gaping | left face | | | older | Unknown |
| 02 | WS | 05/03 | J | M | | puncture | ant.dorsal | | | fresh | P-seal bite |
| 03 | WS | 05/03 | J | F | YN94 | puncture | ant.dorsal | | | fresh | P-seal bite |
| 04 | Ea | 05/18 | A | F | Y162 | circular | post.dors. | 2.0 | 10.0 | fresh | P-small shark |
| 05 | WS | 05/23 | A | F | Y609 | lacerations | dorsal | 4.0 | 30.0x10.0 | fresh | P-mating |
| 06 | Tr | 05/24 | J | M | Y380 | gaping | r.hind flip. | 3.5 | 13.0x 3.5 | fresh | P-shark bite |
| 07 | WS | 05/27 | J | F | YN10 | laceration | head | | 6.5 | fresh | P-seal bite |
| | | | | | | puncture | mid-dorsal | | | | |
| 08 | Di | 05/27 | A | F | | lg.gaping | dorsal | 10.0 | 50.0x? | fresh | P-male mobbing |
| 10 | Ea | 05/30 | A | F | | circular | ant.ventral | 1.0 | 3.0 | fresh | P-small shark |
| 11 | Ea | 05/30 | A | F | Y286 | laceration | left eye | 0.5 | 2.0x1.5 | fresh | Unknown |
| 13 | Ea | 06/01 | J | M | YN36 | part.amput. | l.hind flip. | | | fresh | P-shark bite |
| | | | | | | gaping | r.hind flip. | 1.8 | 6.5x2.0 | fresh | |
| 14 | Te | 06/02 | S | U | | gaping | dorsal | 0.5 | 8.0x6.0 | fresh | P-mating |
| 15 | Te | 06/04 | S | F | Y586 | gaping | dorsal | 5.0 | 40.0x30.0 | fresh | P-male mobbing |
| 16 | Te | 06/04 | A | F | | abcess,lacer. | dorsal | | 20.0x10.0 | fresh | P-male mobbing |
| | | | | | | punctures | dorsal | | | fresh | |
| 17 | Te | 06/04 | A | M | | laceration | r.shoulder | 1.0 | 15.0x? | fresh | Unknown |
| 18 | Ea | 06/19 | A | F | | laceration | post.dorsal | | | fresh | P-mating |
| 19 | Te | 06/23 | A | F | Y147 | gaping,lacer. | dorsal | 1.0 | 45.0x15.0 | fresh | P-male mobbing |
| 20 | Te | 06/25 | A | F | Y573 | laceration | r.post.later. | 0.5 | 13.0x0.3 | fresh | P-mating |
| 21 | WS | 06/25 | W | F | YF41 | abcess,punct. | ant.dorsal | | 20.0x15.0 | fresh | P-seal bite |
| 22 | WS | 06/25 | A | F | Y545 | lacerations | post.ventral | 0.5 | 8.5x0.3 | fresh | Unknown |
| 23 | Te | 06/29 | A | U | | gaping | mid-shoulder | 2.5 | 8.0x5.0 | fresh | Unknown |
| 24 | Tr | 07/01 | A | F | Y151 | gaping | dorsal | 4.5 | 65.0x30.0 | fresh | P-male mobbing |
| 25 | Tr | 07/01 | W | F | YF15 | circular | mid-shoulder | 2.0 | 5.0 | fresh | P-seal bite |
| 26 | LG | 06/30 | A | F | | gaping | mid-dorsal | 3.0 | 20.0x12.0 | fresh | P-male mobbing |
| 27 | Tr | 07/01 | A | M | | lacerations | mid-ventral | 0.3 | 3.0x0.2 | fresh | Unknown |
| 28 | WS | 07/10 | A | F | Q68-88 | gaping | mid-dorsal | 1.5 | 26.0x15.0 | fresh | P-male mobbing |
| 29 | Te | 07/12 | A | M | | circular | r.shoulder | 2.5 | 8.0 | fresh | P-small shark |
| 30 | Te | 07/12 | A | M | | circular | post.dorsal | 2.5 | 7.0 | fresh | P-small shark |
| 31 | Te | 07/12 | A | U | | lacerations | dorsal | 0.5 | 120x20.0 | fresh | P-mating |

Table 16.--Continued.

| Field No. | Islet[a] | Date | Age class[b] | Sex[c] | ID No. | Injury type[d] | Location on body[e] | Dimension(cm.)[f] Depth | Dimension(cm.)[f] lxw/diam | Condition[g] | Cause[h] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | Ea | 07/14 | J | F | YL70 | abcess | l.shoulder | | 15.0x8.0 | fresh | P-seal bite |
| 33 | Te | 07/23 | W | F | YF10 | abcess | mid-shoulder | | 9.0x7.0 | fresh | Unknown |
| 34 | Te | 07/24 | A | F | | gaping | l.post.later. | 1.5 | 8.0x5.0 | fresh | P-mating |
| 35 | Te | 07/24 | A | F | | lacerations | dorsal | 1.0 | 120x20.0 | fresh | P-mating |
| 36 | WS | 07/25 | W | M | YF89 | gaping | l.head | 1.0 | 8.0x2.0 | fresh | Unknown |
| 37 | Ea | 08/08 | J | F | YL41 | gaping | r.post.later. | | 17.5x7.5 | infect. | P-shark bite |
| | | | | | | gaping | l.head | | 12.5x2.5 | infect. | |
| 38 | Te | 08/24 | A | U | | abrasion | r.foreflipper | | 4.0x2.5 | fresh | Unknown |
| 39 | WS | 12/09 | W | U | | amputation | hindflippers | | | healing | P-shark bite |

[a]Island: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Di = Disappearing, and LG = Little Gin.
[b]Age class: A = adult, S = subadult, J = juvenile, and W = weaned pup.
[c]Sex: F = female, M = male, and U = unknown.
[d]Injury type: amput. = amputation, lacer. = laceration, lg. = large, part. = partial, and punct. = puncture.
[e]Location: ant. = anterior, dors. = dorsal, flip. = flipper, later. = lateral, l. = left, post. = posterior, and r. = right.
[f]Dimension: lxw = length by width, diam. = diameter. A single number indicates a diameter.
[g]Comments: inj. = injury; infect = infection.
[h]Cause: P = probable.

Table 17.--Injuries from January 1-December 21, 1989.

| Field No. | Islet[a] | Date | Age class[b] | Sex[c] | ID No. | Injury type[d] | Location on body[e] | Dimension(cm.)[f] Depth | Dimension(cm.)[f] lxw/diam | Condition | Cause[g] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00 | Te | 01/01 | J | F | YL69 | laceration | ventral | 4.0 | 20.0x2.5 | fresh | P-propeller |
| 01 | Te | 03/29 | S | M | | laceration | ant.vent. | 4.0 | 5.5x3.0 | fresh | Unknown |
| 02 | Ea | 03/30 | J | M | YF79 | gaping | r.neck | 2.0 | 17.0x10.0 | fresh | |
| | | | | | | punctures | r.mid-vent. | 1.0 | | fresh | |
| 03 | Ea | 03/30 | A | F | Y529 | laceration | l.ant.vent. | 3.0 | 18.0x0.5 | fresh | P-propeller |
| | | | | | | laceration | mid-ventral | 1.0 | 8.0x0.3 | fresh | |
| 04 | Te | 03/31 | S | F | Y412 | other/swell. | right eye | | | closed | Unknown |
| 05 | Te | 04/02 | S | F | Y633 | laceration | l.mouth | 2.0 | 5.0x4.0 | fresh | Unknown |
| 06 | Te | 04/06 | A | U | | gaping | r.foreflip. | 2.5 | 6.0x3.0 | fresh | P-propeller |
| 07 | Te | 04/06 | J | F | YN08 | laceration | mid-ventral | 3.0 | 9.0x3.0 | fresh | P-propeller |
| 08 | Te | 04/08 | S | M | Y448 | gaping | r.mouth | 3.5 | 5.0x3.5 | fresh | P-propeller |
| 09 | Te | 04/08 | A | F | Y033 | gaping | r.ventral | 12.0 | 36.0x15.0 | fresh | P-propeller |
| | | | | | | gaping(s) | ventral | 3.0 | 13.0x3.0 | fresh | |
| 10 | Te | 04/08 | A | F | Y459 | lacerations | ventral | 2.5 | 9.0x2.0 | fresh | P-propeller |
| 11 | Te | 04/13 | A | M | | gaping | l.foreflip. | 6.0 | 12.0x7.0 | fresh | P-shark |
| | | | | | | lacerations | ant.ventral | 2.0 | 5.0x1.5 | fresh | |
| 12 | Di | 04/17 | J | F | | circular | mid=dorsal | 1.0 | 9.0 | fresh | P-sm.shark |
| 13 | Gi | 04/17 | J | M | Y512 | unknown | post.vent.? | | | bleeding | Unknown |
| 14 | LG | 04/24 | J | U | | circular | post.dorsal | 0.5 | 6.0 | fresh | Unknown |
| 84 | | 04/24 | J | M | YF35 | gaping | dorsal | 1.0 | 8.0x3.0 | fresh | P-propeller |
| 15 | Te | 04/26 | J | F | Y511 | gaping | r.mouth | 3.0 | 6.0x2.5 | fresh | P-propeller |
| | | | | | | lacerations | r.lateral | | | fresh | |
| 16 | Ea | 05/03 | A | F | Y522 | circular | post.vent. | 2.0 | 10.0 | fresh | P-sm.shark |
| 17 | Te | 05/05 | A | F | Y279 | laceration | l.hindflip. | 0.5 | 4.0x2.0 | fresh | Unknown |
| 18 | Te | 05/05 | S | F | X31-89 | lacerations | r.head | 0.5 | 3.0x1.0 | fresh | Unknown |
| 19 | Tr | 05/05 | S | F | Y415 | gaping | l.lateral | 4.5 | 22.0 | fresh | P-shark |
| 20 | WS | 05/05 | A | M | | gaping | r.lateral | 1.5 | 8.0x3.0 | fresh | P-shark |
| 21 | Te | 05/09 | S | M | | other/broke | r.jaw | | | fresh | Unknown |
| | | | | | | lacerations | dorsal | 0.5 | 6.0x0.5 | fresh | P-mating |
| 22 | Sh | 05/09 | A | U | | gaping | dorsal | 3.0 | 40.0x22.0 | fresh | P-mating |
| | | | | | | lacerations | dorsal | | | fresh | |
| 23 | Gi | 05/11 | A | F | | laceration | vent.neck | 3.0 | 5.0x2.0 | fresh | Unknown |

Table 17.--Continued.

| Field No. | Islet[a] | Date | Age class[b] | Sex[c] | ID No. | Injury type[d] | Location on body[e] | Dimension(cm.)[f] Depth | lxw/diam | Condition | Cause[g] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | Sh | 05/12 | A | M | | laceration | l.hindflip. | 2.0 | 9.0x3.0 | fresh | P-shark |
| 25 | Te | 05/12 | A | M | | lacerations | vent.hindfl. | 1.0 | 4.0x1.0 | fresh | P-shark |
| 26 | Ea | 05/02 | J | F | Y499 | part.amput. | l.hindflip. | | 3.0x2.0 | tip chop | Unknown |
| 27 | Te | 05/08 | A | F | Y617 | lacerations | ventral | 7.0 | 12.0x4.0 | fresh | P-shark |
| 28 | Sh | 05/18 | S | F | Y327 | laceration | l.ventral | 0.5 | 6.0x0.5 | bleeding | Unknown |
| 29 | Tr | 05/18 | A | M | | laceration | l.foreflip. | | 5.5x4.0 | fresh | Unknown |
| | | | | | | abrasion | l.foreflip. | | 2.0x2.0 | fresh | |
| 30 | Te | 05/21 | J | M | YN45 | gaping | l.hindflip. | 1.5 | 8.0x6.0 | fresh | P-shark |
| | | | | | | part.amput. | r.hindflip. | | 8.0x7.0 | #5 digit | |
| 31 | Te | 05/21 | S | F | Y328 | lacerations | hindflips. | 1.5 | 7.0x1.0 | fresh | P-shark |
| 32 | Te | 05/25 | J | F | YL69 | laceration | r.lateral | 0.5 | 6.0x? | fresh | Unknown |
| 33 | Te | 05/25 | J | M | Y387 | gaping(s) | l.head | 1.5 | 15.0x? | 3 gashes | P-shark |
| 34 | Te | 05/26 | J | F | Y315 | laceration | r.lateral | | | fresh | P-propeller |
| | | | | | | lacerations | l.lateral | | | fresh | |
| 35 | Te | 05/28 | J | M | Y376 | laceration | ventral | 1.5 | 8.0x1.0 | fresh | Unknown |
| 36 | Te | 06/09 | S | F | Y635 | gaping(s) | dorsal | 1.5 | 6.0x4.0 | fresh | P-mating |
| | | | | | | lacerations | dorsal | | | fresh | |
| 37 | Te | 06/09 | A | F | Y589 | lacerations | dorsal | 2.0 | 3.0x2.0 | fresh | Unknown |
| 38 | Te | 06/10 | S | M | Y395 | lacerations | ventral | 1.5 | 6.0x? | fresh | P-shark |
| 39 | Te | 06/09 | S | U | | lacerations | r.head | <1.0 | 1.5x0.5 | fresh | Unknown |
| 40 | Te | 06/13 | J | F | YN37 | laceration | l.hindflip. | <1.0 | 6.0x0.5 | fresh | Unknown |
| 41 | Te | 06/13 | S | F | Y308 | lacerations | ventral | <0.5 | 6.0x0.5 | fresh | P-mating |
| 42 | Te | 06/13 | S | F | | lacerations | l.lateral | <0.5 | 9.0x0.5 | fresh | P-mating |
| 43 | Te | 06/13 | S | F | X09-89 | lacerations | dorsal | <0.5 | 9.0x0.5 | fresh | P-mating |
| 44 | Te | 06/15 | J | M | Y486 | circular | dors.head | 0.7 | 2.0 | fresh | Unknown |
| 45 | Te | 06/19 | A | F | Y199 | lacerations | dorsal | 0.7 | 9.0x0.5 | fresh | P-mating |
| 46 | Te | 06/22 | A | M | | laceration | r.foreflip. | <0.5 | 1.5x1.0 | fresh | P-seal bite |
| 47 | Te | 06/22 | A | M | | laceration | l.lateral | 0.5 | 2.0x0.5 | fresh | P-seal bite |
| 48 | Te | 06/22 | S | F | Y606 | lacerations | mid-dors. | 0.5 | 6.0x0.5 | fresh | P-mating |
| 49 | Te | 07/01 | S | M | | laceration | r.lateral | 1.0 | 5.0x3.0 | fresh | Unknown |
| 50 | Te | 07/06 | J | M | YL42 | gaping | dorsal | 3.0 | 55.0x25.0 | fresh | P-mating |
| 51 | WS | 07/07 | A | F | X22-89 | circular | dorsal | 1.5 | 7.0 | fresh | P-sm.shark |

Table 17.--Continued.

| Field No. | Islet[a] | Date | Age class[b] | Sex[c] | ID No. | Injury type[d] | Location on body[e] | Dimension(cm.)[f] Depth | Dimension(cm.)[f] lxw/diam | Condition | Cause[g] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 52 | Te | 07/07 | S | F | Y377 | gaping | dorsal | 3.0 | 29.0x20.0 | fresh | P-mating |
| 53 | Ea | 07/09 | S | F | Y351 | circular | r.lateral | 2.0 | 8.0 | fresh | P-sm.shark |
| | | | | | | abrasions | r.lateral | | | fresh | P-mating |
| 54 | Te | 07/10 | A | F | Y626 | laceration | r.post.dors. | 1.5 | 6.0x3.0 | fresh | P-shark |
| 55 | Tr | 07/10 | A | F | Y063 | lacerations | r.mid-dors. | 0.5 | 12.0x0.5 | fresh | P-mating |
| 56 | Sh | 07/10 | A | F | Y011 | amputation | l.hindflip. | | | 75%gone | P-shark |
| | | | | | | part.amput. | r.hindlfip. | | | 2 tips | |
| 57 | Te | 07/22 | A | F | Y335 | gaping(s) | mid-dors. | 2.5 | 12.0x6.0 | fresh | P-mating |
| | | | | | | | mid-dors. | 2.5 | 5.0x4.0 | fresh | |
| 58 | Ea | 07/25 | S | F | Y378 | gaping | dors.neck | 2.0 | 17.0x12.0 | fresh | P-shark |
| | | | | | | lacerations | dors.neck | 1.0 | 10.0x0.5 | fresh | |
| 59 | Te | 07/22 | J | F | YL48 | circular | ant.dors. | 1.0 | 3.0 | 2 wounds | Unknown |
| 60 | Sh | 07/20 | J | M | YN96 | puncture | head | | | | |
| 61 | Ea | 07/26 | W | M | YU65 | laceration | mid-dors. | 0.5 | 3.0x0.5 | fresh | Unknown |
| 62 | WS | 07/27 | S | U | | laceration | r.head | 0.5 | 4.0x0.5 | fresh | Unknown |
| 63 | Te | 08/02 | A | F | Z01-89 | lacerations | ant.vent. | 3.0 | 12.0x2.0 | fresh | P-shark |
| 64 | Te | 08/07 | W | M | YU31 | gaping(s) | l.hindflip, | 3.0 | 10.0x3.0 | fresh | P-shark |
| | | | | | | | post.dors. | | | fresh | |
| | | | | | | amputation | r.hindflip. | | | total | |
| 65 | WS | 08/04 | S | F | Y435 | gaping | dorsal | 3.0 | 25.0x10.0 | recent | P-mating |
| 66 | Te | 08/07 | S | M | | gaping | r.hindflip. | 3.5 | 9.0x5.0 | fresh | Unknown |
| 67 | WS | 08/07 | J | M | YN95 | lacerations | ant.vent. | 0.5 | 25.0x0.5 | multiple | P-shark |
| 68 | Ea | 08/09 | J | U | | circular | ant.dors. | 0.5 | 3.0 | fresh | P-sm.shark |
| 69 | Ea | 08/09 | J | F | YF99 | gaping | vent.neck | 4.0 | 15.0x8.0 | fresh | P-shark |
| 70 | Te | 08/10 | J | M | Y448 | abcess | ant.dors. | | 10.0 | fresh | P-seal bite |
| 71 | WS | 08/10 | A | F | Y022 | laceration | r.lateral | 0.5 | 8.0x0.5 | fresh | P-mating |
| 72 | WS | 08/10 | W | M | YU64 | abcess | ant.dors. | | 5.0x15.0 | | P-seal bite |
| 73 | WS | 08/10 | W | M | YU79 | abcess | ant.dors. | | 25.0x15.0 | recent | P-seal bite |
| 74 | WS | 08/10 | A | M | | circular | ant.dors. | 0.5 | 5.0 | fresh | Unknown |
| 75 | WS | 08/14 | W | F | YU71 | abcess | ant.dors. | | 15.0x15.0 | recent | P-seal bite |
| 76 | WS | 08/17 | W | M | YU89 | abcess | ant.dors. | 1.0 | 20.0x16.0 | recent | P-seal bite |

Table 17.--Continued.

| Field No. | Islet[a] | Date | Age class[b] | Sex[c] | ID No. | Injury type[d] | Location on body[e] | Dimension(cm.)[f] Depth | Dimension(cm.)[f] lxw/diam | Condition | Cause[g] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 77 | Ea | 08/27 | A | F | E27-89 | gaping | r.lateral | 2.0 | 10.0x5.0 | fresh | P-shark |
| | | | | | | punctures | r.mid-vent. | 1.0 | 1.0x0.5 | multiple | |
| 78 | Ea | 08/27 | J | M | YN32 | gaping(s) | hindlfips. | 3.0 | 8.0x5.0 | multiple | P-shark |
| 79 | Te | 08/28 | S | F | Y366 | gaping | ant.vent. | 2.0 | 10.0x3.0 | fresh | P-propeller |
| 80 | WS | 08/28 | A | M | | part.amput. | r.hindflip. | | 5.0x2.5 | fresh | Unknown |
| 81 | Te | 08/29 | J | F | Y490 | laceration | ant.vent. | 2.0 | 7.0x2.0 | fresh | P-shark |
| 82 | Te | 08/30 | A | M | | gaping | ant.vent. | 3.0 | 40.0x20.0 | fresh | P-shark |
| 83 | Te | 08/31 | A | F | | laceration | l.lateral | 2.0 | 6.0x2.0 | fresh | P-shark |
| 85 | Te | 10/24 | S | M | Y434 | gaping | l.head | | | died | Unknown |
| | | | | | | lacerations | post.dors. | | 12.5x1.0 | recent | P-propeller |
| 86 | Te | 11/02 | S | M | YL13 | amputation | l.hindflip. | | total | | P-shark |
| | | | | | | part.amput. | r.hindflip. | | 25%gone | | |
| 87 | Te | 11/20 | W | F | YU25 | gaping | l.foreflip. | 2.5 | 13.0x5.0 | fresh | P-shark |
| 88 | Te | 11/30 | W | F | YU63 | gaping | post.dorsal | 5.0 | 20.0x12.5 | fresh | P-shark |
| 89 | Te | 12/07 | W | M | YU62 | gaping | r.lateral | 2.5 | 18.0x10.0 | recent | P-shark |
| 90 | Te | 12/11 | S | M | Y304 | lacerations | dors.neck | 1.5 | 30.0x2.5 | recent | Unknown |
| 91 | Te | 12/14 | J | M | YN02 | gaping | r.hindflip. | 2.5 | 10.0x2.5 | recent | P-shark |
| | | | | | | laceration | l.hindflip. | 1.0 | 10.0x1.0 | recent | |
| 92 | Te | 12/18 | A | M | | gaping | ant.ventral | 2.0 | 25.0x15.0 | recent | P-shark |
| 93 | Te | 12/21 | J | F | YL20 | gaping | l.foreflip. | 0.5 | 10.0x7.5 | fresh | P-shark |
| | | | | | | laceration | ant.ventral | 0.5 | 20.0x1.0 | fresh | |

[a]Island: Te = Tern, Ea = East, WS = Whaleskate, Tr = Trig, Di = Disappearing, and LG = Little Gin.
[b]Age class: A = adult, S = subadult, J = juvenile, and W = weaned pup.
[c]Sex: F = female, M = male, and U = unknown.
[d]Injury type: amput. = amputation, lacer. = laceration, lg. = large, part. = partial, and punct. = puncture.
[e]Location: ant. = anterior, dors. = dorsal, flip. = flipper, later. = lateral, l. = left, post. = posterior, and r. = right.
[f]Dimension: lxw = length by width, diam. = diameter. A single number indicates a diameter.
[g]Cause: K = known; P = probable.

Table 18.--Deaths between April 11, 1988 and December 1, 1989.

| Death No. | Death date | Age class[a] | Sex[b] | ID No. | Cause or known(K) or probable(P) | Necropsy No. |
|---|---|---|---|---|---|---|
| 01FFS88 | 05/23/88 | J | F | YN42 | P-Snout injury | 01FFS88 |
| 02FFS88 | 07/20/88 | J | M | YN23 | Unknown | 02FFS88 |
| 03FFS88 | 05/29/88 | P | U | YFX1 | Unknown | |
| 04FFS88 | 11/17/88 | P | U | YFX2 | Unknown | |
| 05FFS88 | 12/19/88 | P | U | YFX3 | Unknown | |
| 01FFS89 | 03/27/89 | J | M | YF82 | P-shark bite | 01FFS89 |
| 02FFS89 | 04/04/89 | P | F | YUX1 | K-stillborn | |
| 03FFS89 | <02/03/89 | J | F | YF15 | Unknown,decayed | |
| 04FFS89 | <04/01/89 | J | M | YF57 | Unknown,decayed | |
| 05FFS89 | 04/10/89 | P | M | YUX2 | K-drowned | |
| 06FFS89 | <04/01/89 | A | U | | Unknown,decayed | |
| 07FFS89 | 04/17/89 | J | F | YF38 | Unknown | |
| 08FFS89 | <04/17/89 | P | F | YUX3 | Unknown,decayed | |
| 09FFS89 | <04/16/89 | J | M | YN30 | Unknown,decayed | |
| 10FFS89 | 04/11/89 | J | M | | Unknown | |
| 11FFS89 | 04/11/89 | S | M | | Unknown | |
| 12FFS89 | 04/17/89 | S | U | | Unknown,decayed | |
| 13FFS89 | 04/22/89 | P | U | YUX4 | Unknown | |
| 14FFS89 | 05/04/89 | P | U | YUX5 | Unknown | |
| 15FFS89 | 04/17/89 | J | F | YL07 | Unknown,decayed | |
| 16FFS89 | 05/12/89 | P | U | YUX6 | Unknown | |
| 17FFS89 | 05/20/89 | P | F | YUX7 | Unknown | 02FFS89 |
| 18FFS89 | 05/25/89 | J | F | YF96 | Unknown | 03FFS89 |
| 19FFS89 | 05/30/89 | J | F | YF23 | Unknown | |
| 20FFS89 | 06/11/89 | A | M | | P-old age | 04FFS89 |
| 21FFS89 | 06/25/89 | J | F | YN98 | Unknown | |
| 22FFS89 | >06/12/89 | P | M | YU22 | Unk.-disappeared | |
| 23FFS89 | >07/07/89 | P | M | YUX8 | Unk.-disappeared | |
| 24FFS89 | 07/21/89 | J | M | YL84 | Unknown | 05FFS89 |
| 25FFS89 | >07/10/89 | P | U | YUX9 | Unk.-disappeared | |
| 26FFS89 | 08/03/89 | P | F | YUXA | Unknown | 06FFS89 |
| 27FFS89 | >08/10/89 | P | M | YUXB | K-starved,disapp. | |
| 28FFS89 | 08/22/89 | A | F | Y519 | P-drowned | 07FFS89 |
| 29FFS89 | 08/25/89 | J | U | | K-shark-eaten | |
| 30FFS89 | >04/11/89 | P | U | YUXC | Unk.-disappeared | |
| 31FFS89 | >04/28/89 | P | U | YUXD | Unk.-disappeared | |
| 32FFS89 | >05/02/89 | P | U | YUXE | Unk.-disappeared | |
| 33FFS89 | 10/24/89 | S | M | Y434 | P-injury,starvat. | |
| 34FFS89 | 11//89 | P | U | YUXF | K-stillborn | |

[a]Age class: A = adult, S = subadult, J = juvenile, and P = neonatal pup.
[b]Sex: F = female, M = male, and U = unknown.

# FIGURES

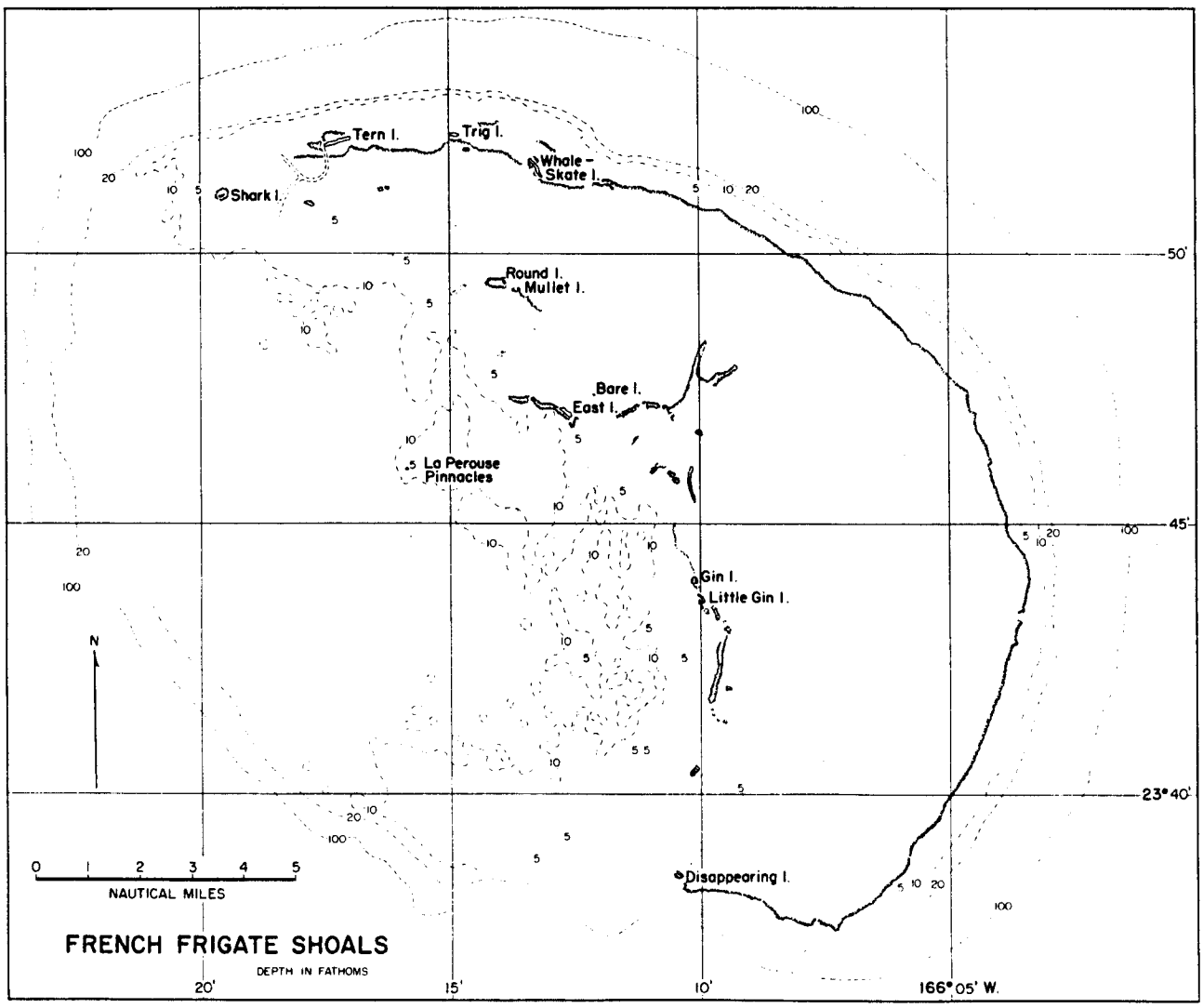


FIGURE 1. Permanent islands at French Frigate Shoals.

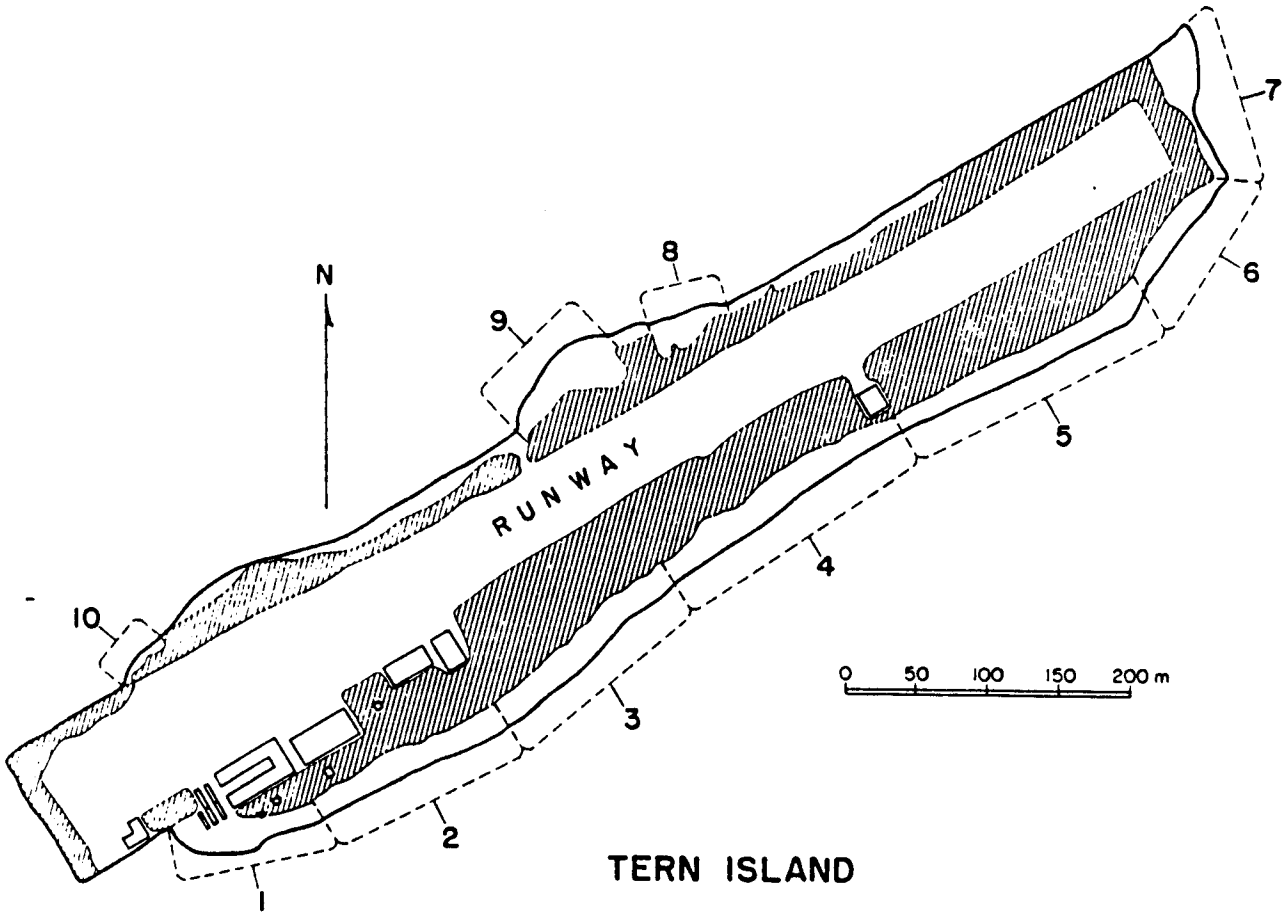


FIGURE 2. Tern I., FFS divided into sectors used in censuses.

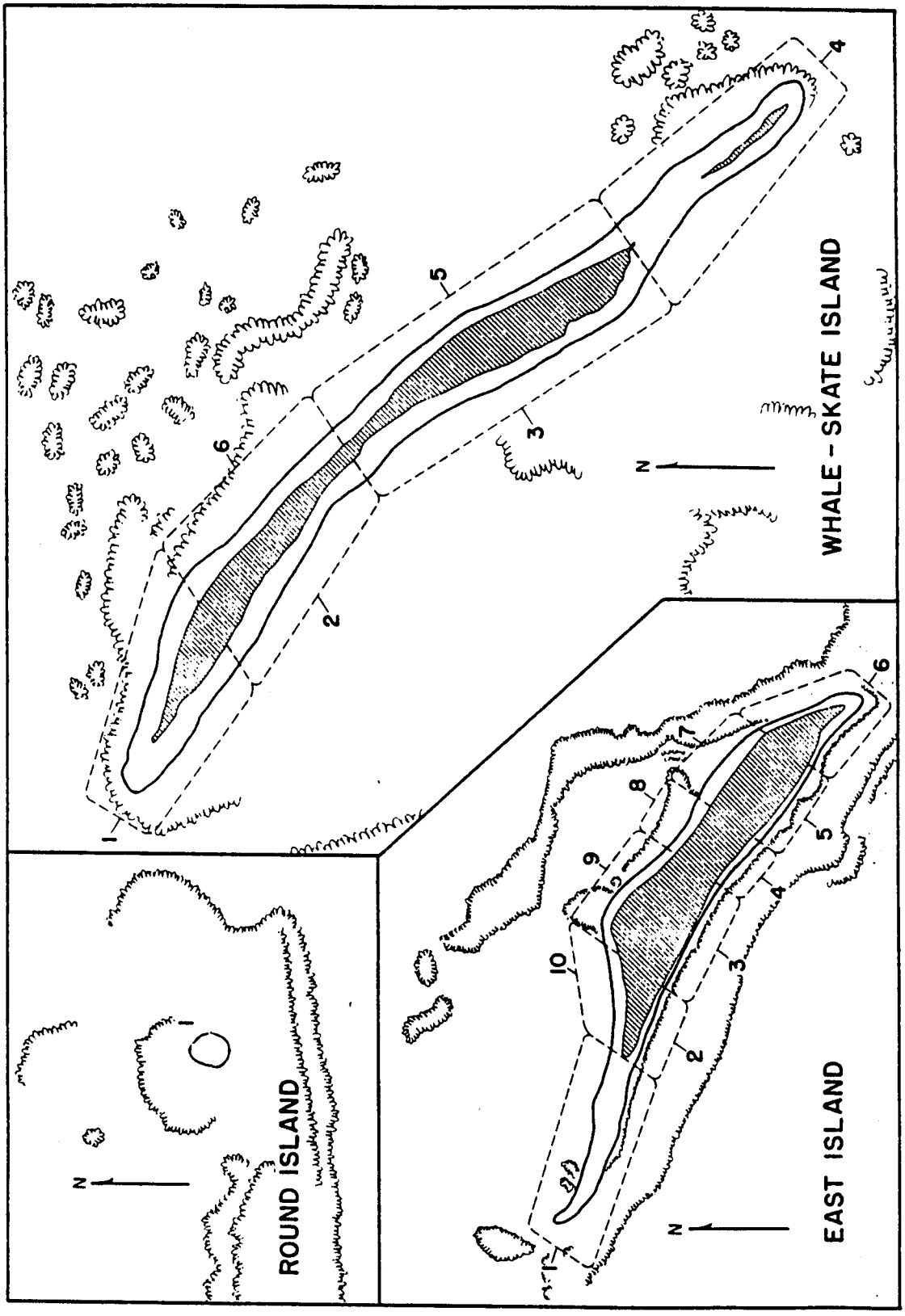


FIGURE 3. The major pupping islands; East, Whaleskate, and Round, divided into sectors used in censuses.

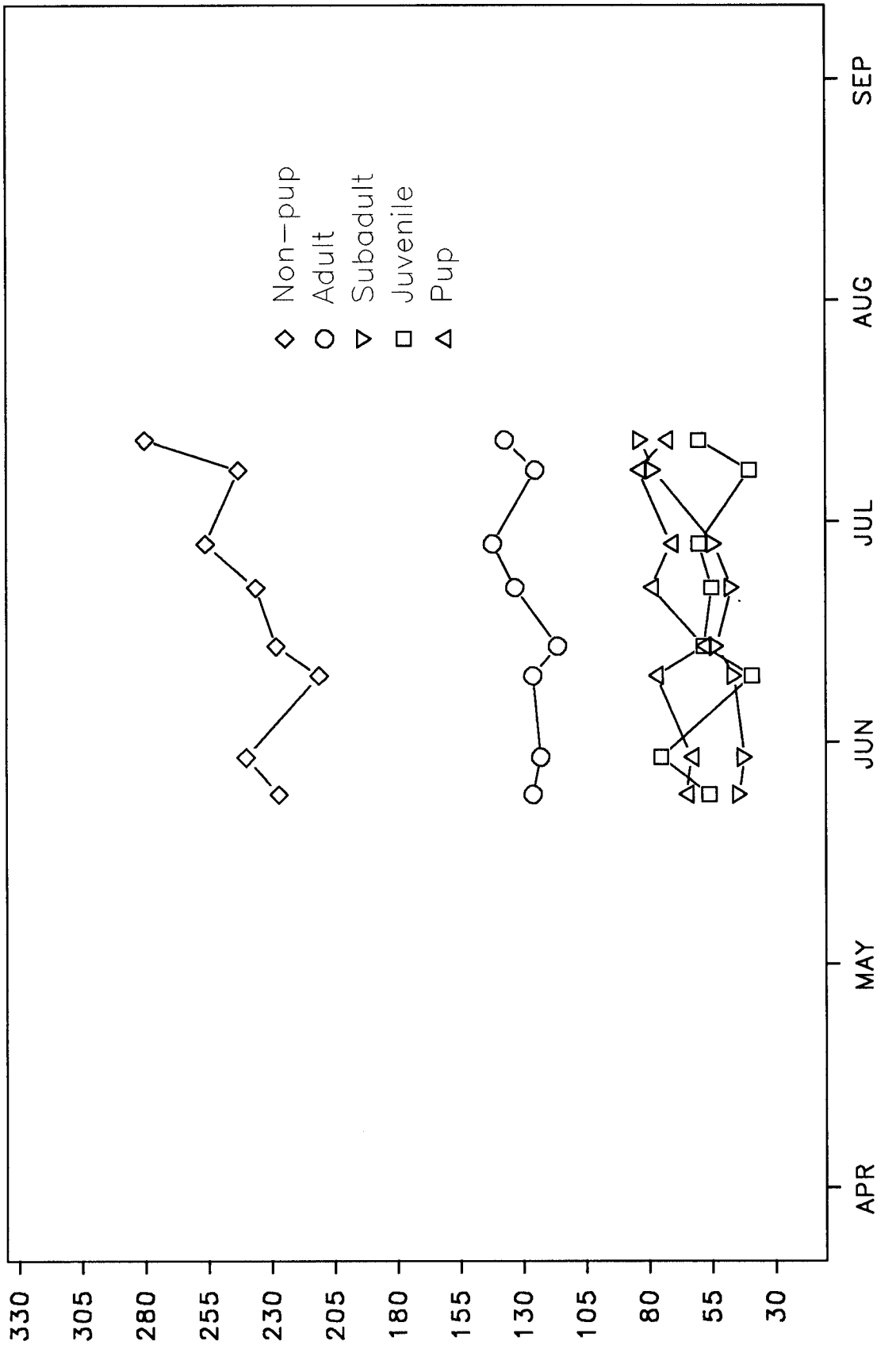


Figure 4. Non-pup and age class totals from 1988 atoll censuses.

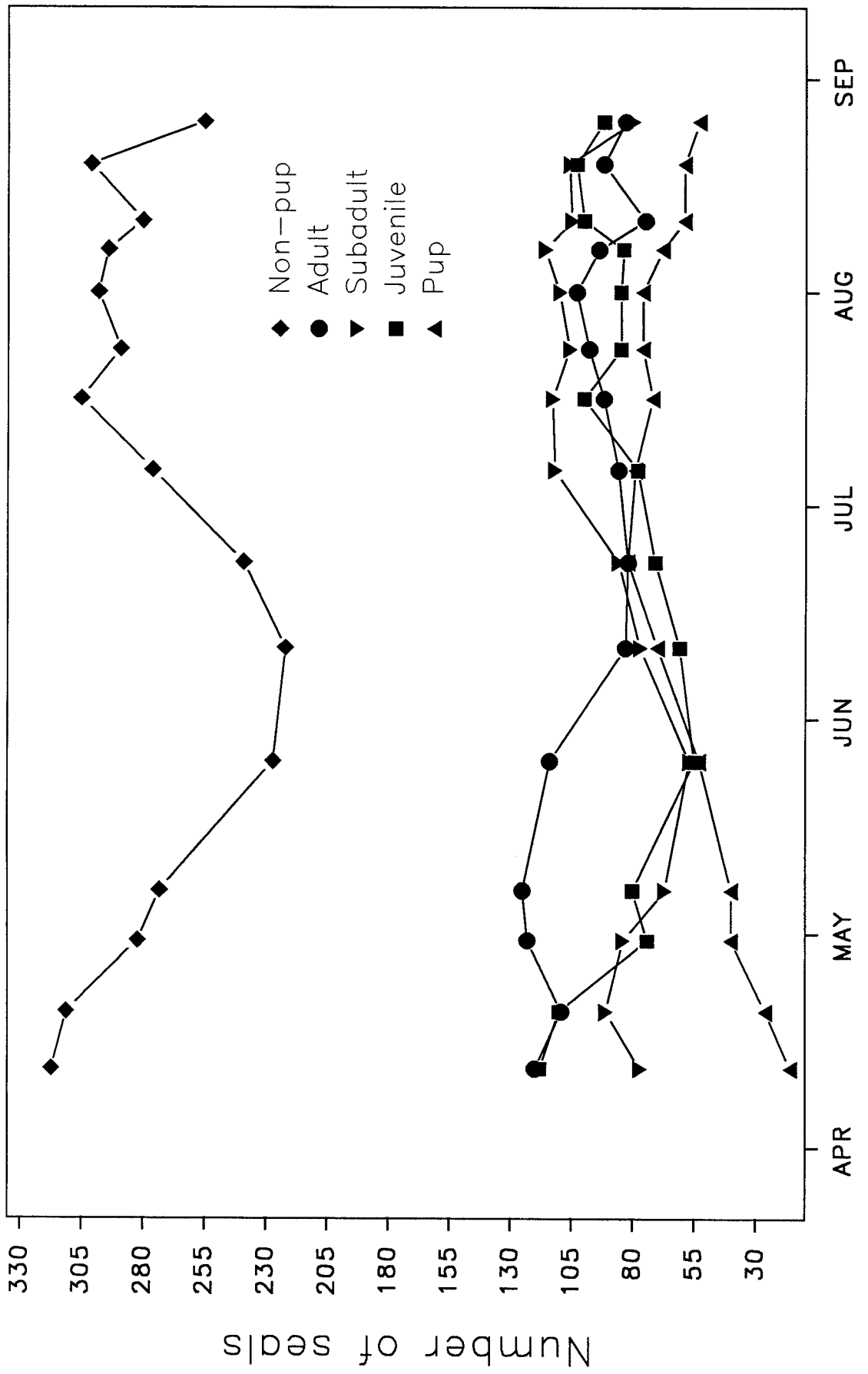


Figure 5. Non-pup and age class totals from 1989 atoll censuses.

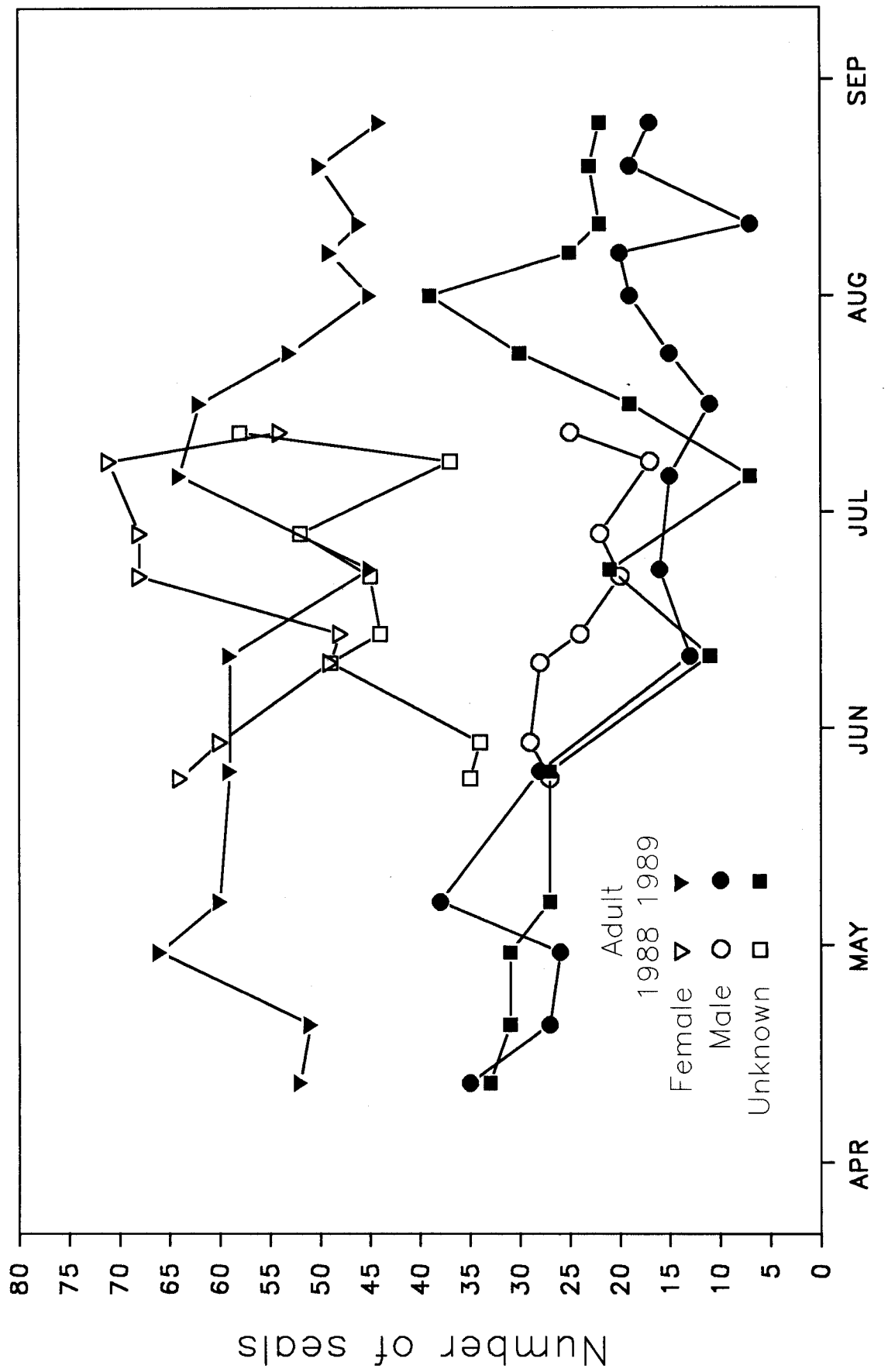


Figure 6. Number of adult seals by sex class from 1988 and 1989 atoll censuses.

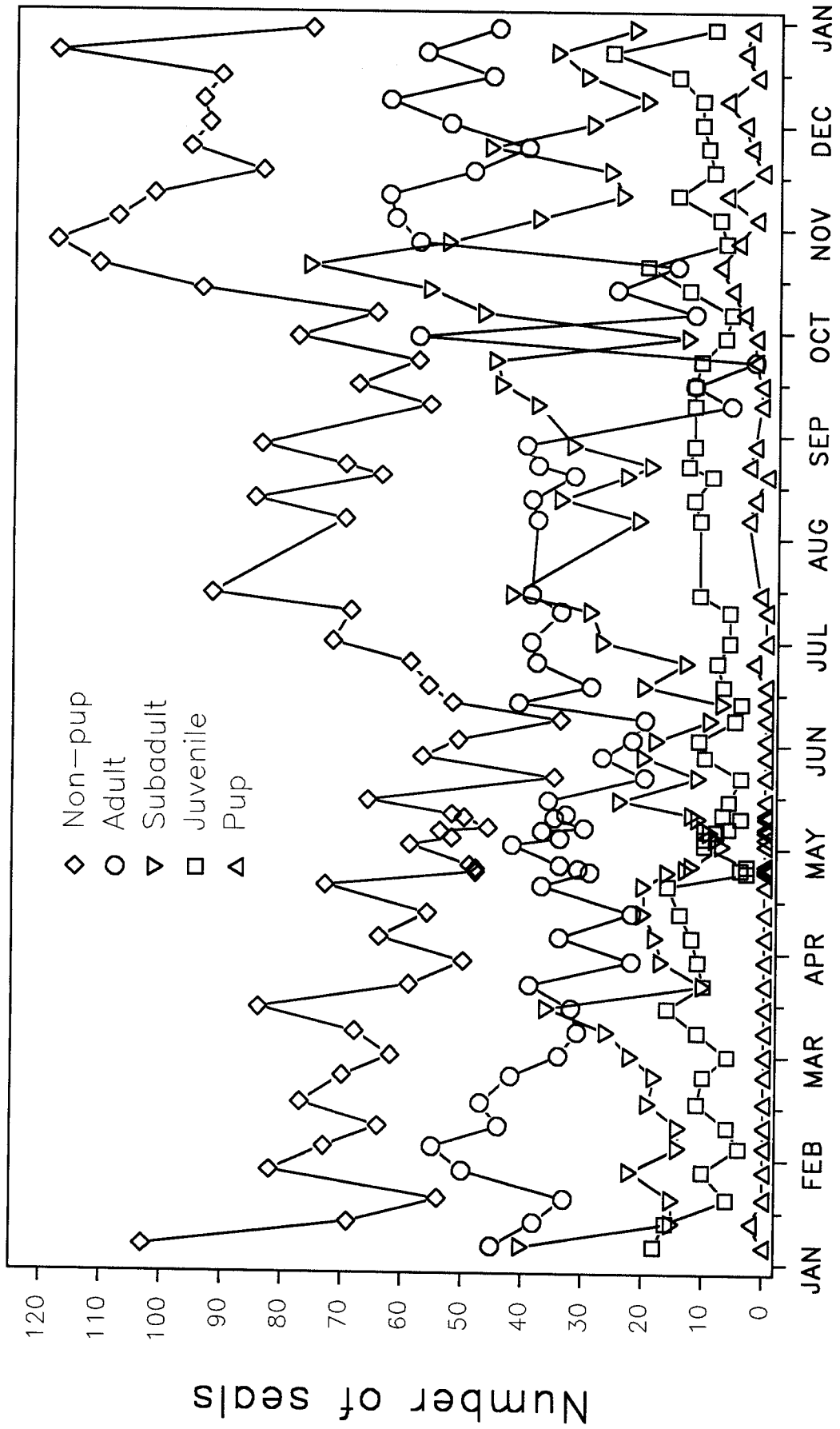


Figure 7. Non-pup and age class totals from 1988 Tern Island censuses.

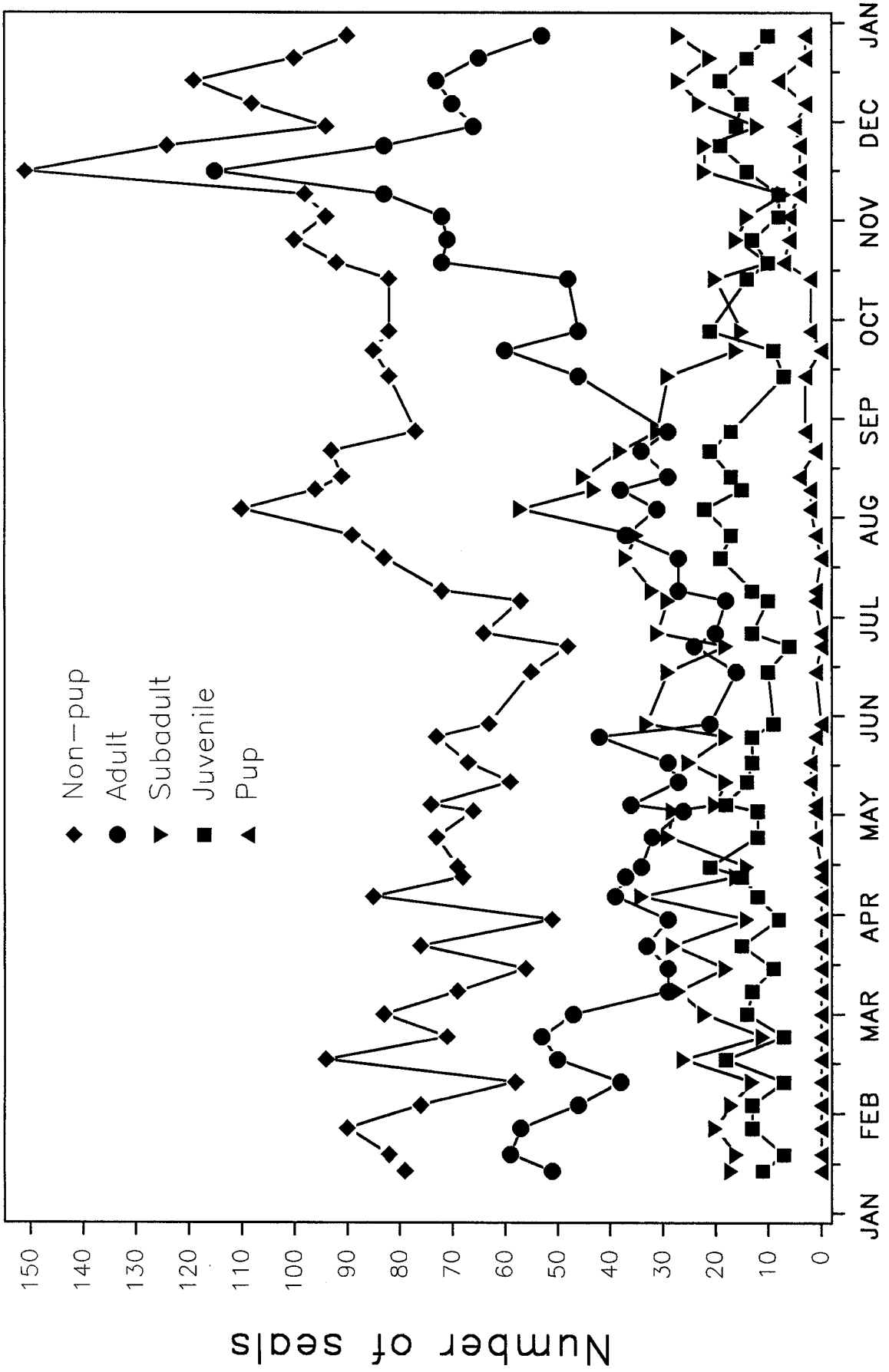


Figure 8. Non-pup and age class totals from 1989 Tern Island censuses.

# APPENDIXES

Appendix A.--Itinerary of fieldwork conducted at French Frigate Shoals in 1988 by the National Marine Fisheries Service.

| Date | Event |
|---|---|
| 04/11 | Fishing vessel Feresa disembarked R. Forsyth and L. Dean. |
| 04/12 | Research began. |
| 05/12 | NOAA ship Townsend Cromwell disembarked G. Balazs, S. Moriarty, H. Freifeld, G Nakai, T. Gerrodette, and A. Marks and embarked R. Forsyth and L. Dean. |
| 05/13 | Pups YF02, YF08, and YF09 were flown to Oahu. |
| 05/21 | Townsend Cromwell disembarked M. Craig and embarked G. Balazs and A. Marks. |
| 05/25 | Green turtle camp setup on Whaleskate Island and research began there. |
| 06/06 | Townsend Cromwell disembarked P. Dye. |
| 06/09 | Charter airplane Venture 1 disembarked R. Withrow, J. Licciardi, and L. Fukuda and embarked T. Gerrodette and rehab. pups YF18, YF32, and YF36 bound for Oahu. |
| 06/14 | Venture 1 disembarked J. Lenox and embarked G. Nakai and rehab. pup YF48 bound for Oahu. |
| 06/22 | Townsend Cromwell embarked R. Withrow, J. Licciardi, and H. Freifeld. |
| 07/09 | Townsend Cromwell disembarked T. Clark. |
| 07/19 | Sailing vessel Climax disembarked M. Brown. |
| 07/25 | Venture 1 embarked M. Craig, J. Lenox, and S. Moriarty bound for Oahu. |
| 08/13 | Feresa disembarked D. Alcorn, A. Marks, M. Jacobs, and B. Choy. |
| 08/16 | Feresa departed with P. Dye and T. Clark for Oahu. |
| 08/23 | Venture 1 embarked M. Brown and L. Fukuda bound for Oahu. |
| 08/30 | Field season for NMFS personnel ended. |
| 08/31 | Townsend Cromwell embarked D. Alcorn, B. Choy, A. Marks, and M. Jacobs. |

Appendix B.--Itinerary of fieldwork conducted on French Frigate Shoals in 1989 by the National Marine Fisheries Service.

| Date | Event |
|---|---|
| 03/25 | NOAA ship Townsend Cromwell arrived and disembarked M. Craig and L. Gill. Field camp was established. |
| 03/27 | Research commenced. |
| 04/30 | Rehabilitation pup YU03 was sent to Oahu via charter airplane of Pearl Pacific Airways (PPA). |
| 05/26 | PPA embarked L. Gill bound for Oahu. |
| 06/19 | Townsend Cromwell disembarked C. Lorence. |
| 06/30 | Rehab. pup YU40 was sent to Oahu via PPA. |
| 07/13 | Rehab. pup YU48 was sent to Oahu via research ship Kila. |
| 07/15 | Townsend Cromwell disembarked M. Lee and embarked C. Lorence. |
| 09/03 | Research by NMFS ended. |
| 09/04 | PPA embarked M. Craig and M. Lee bound for Oahu. |

Appendix C.--Directions for the 1989 Census Form.

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ISLAND--Name of island and atoll; e.g., East, FFS

OBSERVER--Three initials

TIME BEGIN and END--On a 24-hour clock, e.g., 6 p.m. = 1800, for the group of pages

DATA TYPE--C = Census = a complete count on an island begun around 1300
A = Atoll-wide census (usually completed during 1 day)
P = Patrol = any other observation not on a timed census
I = Incidental observations
Other letters may be used at your discretion to indicate specific kinds of non-census data, e.g., M for male observations.

NUMBER--Censuses and patrols may be assigned numbers at your discretion. Atoll counts extending over more than 1 day must be numbered.

PAGE--If census (or patrol) requires three pages, then mark first page as "page 1 of 3" and so on. If more than 1 person conducts the census, then combine page numbers; person A has pages 1 and 2, while person B has pages 3 and 4 of a four-page census day.

TEMP.--Temperature in degrees Celsius at beginning of census or patrol

WIND--Speed: 0 = no wind, calm (<5 knots)
1 = light breeze (5-15 knots)
2 = strong wind (>15 knots)
Direction: NW, NN, NE, EE, SW, SS, SE, WW

Thus, 2 N N = strong wind from north

CLOUD--Cloud cover: 00 = no clouds
01-09 = 10 to 90% cover
10 = 100% cover

PREC.--Precipitation: 0 = no precipitation or trace
1 = mist/drizzle
2 = rain
3 = intermittent rain

Appendix C.--Continued.

SECTOR--Location on island (e.g., 1-49 on Lisianski; 99 = no island)

SIZE--P1 = Nursing pup, wrinkles
P2 = Nursing pup, no wrinkles
P3 = Nursing pup, blimp, black
P4 = Nursing pup, molting
P5 = Nursing pup, molted
} P = Nursing pup

PW = Prematurely weaned (undersized) pup
W = Weaned pup
J1 = Juvenile I
J2 = Juvenile II
S3 = Subadult III
S4 = Subadult IV
} J = Juvenile, S = Subadult; I = Immature

A = Adult
T1 = Turtle, juvenile (<65 cm)
T2 = Turtle, subadult (65-80 cm)
T3 = Turtle, adult (>80 cm)
} T = Turtle

U = Seal of unknown size

SEX--M = Male
F = Female
U = Unknown

ID--Record ID number of seal if known; right justified: seal #25 = __25

? column: √ or 1 = ID number is questionable
0 = seal is definitely not an IDed animal

BLEACH--Bleach number of seal if known; right justified; these columns may also be used for any temporary numbers assigned in the field

? column: √ or 1 = bleach is present, but the number is questionable
0 = seal is definitely unmarked
4 = partially read bleach number completed from other data

TAG--Tag number if known; right justified: tag #K23 = __K23.

L/R: Tag position L = tag on left flipper
R = tag on right flipper
B = tags on both flippers
(only one tag number need be entered)

Appendix C.--Continued.

COL--Color code: T = tan (Laysan) R = red (Midway, Necker, Nihoa)
K = gray (Kure)
Y = yellow (FFS) B = blue (Pearl and Hermes)
M = metal P = plastic Riese
G = green (Lisianski)

? column: √ or 1 = seal is tagged, but the number is questionable
0 = seal is definitely not tagged
4 = partially read tag completed from other data
5 = incompletely read tag, but partial data are certain

BEACH POS.--Location of seal or turtle when observer comes abreast of animal (e.g., if seal is seen midbeach from a distance and yet is at the waterline when the observer comes abreast, the seal is recorded as being at the waterline).

0 = animal floating in water or on an offshore rock (not included in census tally but may be used for behavioral data)
1 = along waterline, on wet sand
2 = midbeach, on dry sand
3 = presentation zone or beach crest, on permanent beach

MOLT--Percentage of old pelage lost, optional for nursing pups

blank or 0 = no molting evident
__1-_99 = 1 to 99% molted (right justified)
100 = 100% molted, freshly molted, up to 1 month after molt

? column: √ or 1 = % molt estimate is questionable
0 = seal is definitely not molting

Appendix C.--Continued.

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DISTURB--The degree to which the seal may have been disturbed by observer

blank or 0 = no disturbance, or seal merely looked at observer
1 = seal vocalized, gestured, or moved ≤2 body lengths
2 = seal alerted to observer and moved >2 body lengths
3 = seal alerted to observer and fled into water

TIME--The time of an observation, on a 24-hour clock

ASSOCIATION DATA--There is room to describe two different associations (A and B).

Active associations
1) noted for all except behaviors between mother and nursing pup
2) must take place within 30 m of observer
3) subjects may be any distance apart

Spatial associations
1) noted as observer comes abreast of the subject
2) entangling object: distances <2 m away
3) individual seals and turtles
- mother-pup pair (N): any distance
- all others (L): distances ≤10 m away, record two nearest neighbors in straight line of sight
- record seal-seal and turtle-seal but not turtle-turtle associations

LINE NO.--Identity of the other party in the association

1) if a seal or turtle, put its line number here (note line number refers to within same census page only)
2) if an entangling object, put
NR or 99 = net and/or rope
FL or 98 = flotsam other than above

DIST.--Closest distance during behavior
0 = body contact
1 = <2 m
2 = 2-5 m
3 = >5 m (>5 m but ≤10 m in the case of L behavior code)

Appendix C.--Continued.

BEHAVIOR--Up to four behaviors may be recorded for each association, but N, E, X, and O should not appear together with other behaviors.

1) individual seal or turtle
   a) active behavior
      A = approach/investigate/sniff/nudge
      B1 = bite, nip
      B2 = bite, draws blood/breaks skin
      → B = bite
      C1 = chase, ≤2 body lengths*
      C2 = chase, >2 body lengths*
      → C = chase*
      D = displace*
      F1 = flee/move away, ≤2 body lengths
      F2 = flee/move away, >2 body lengths
      → F = flee/moveaway
      J1 = joust ≤30 s*
      J2 = joust >30 s*
      → J = joust/spar/fight*
      M1 = mount/attempted mount ≤30s
      M2 = mount/attempted mount >30 s
      → M = mount/attempted
      P = play*
      R = roll/present ventral
      V = vocalize
      Z = cruising (does not require a line number reference to an associated seal, but may have one)

   b) spatial association
      N = mother-pup pair (any distance)
      L = association by location only (distance ≤10 m apart, for all except mother-pup pairs)

   c) contests (optional)
      L1 = pair association*
      Q = loser*
      W = winner*
      Y = tie*

2) entangling object
   L = association by location only (distance <2 m)
   E = subject is entangled

3) nothing nearby
   O = no behavior or association

4) no data
   X = no association data on census

*requires a corresponding code on the line of the associated seal

Appendix C.--Continued.

CONTINUE--If the same animal is recorded on another line for any reason (e.g., additional tag or association, behavior at a later time, change of beach position), put the line number you are continuing <u>from</u> here. Lines may be continued only within the same page.

NOTES--√ or 1 if you have handwritten notes on the observation. Put handwritten notes on the back of the census form, labeled by line number. The following note codes have specific meanings:

L = observation is purely incidental--i.e., not on census or patrol
R = seal is on rock offshore (combined with beach position 0)
D = seal is dead

<u>Additional notes</u>:

1. Weather information (except temperature) should be a summary of the entire day up until the end of the census, not merely an instantaneous observation.

2. A separate data sheet should be filled out for each date, observer, data type, and island within an atoll. If no seals are present, you should still fill out the information at the top of the census form and write "No seals" in the data area. If the island itself is not present, indicate this by using "99" for the sector code, leaving the rest of the (first) line blank.

3. All associations (except with entangling objects) should be in pairs, i.e., between animals on two different lines. If the behavior is active, you should fill in the line numbers, distances, and behavior codes for both animals involved in the association. If the behavior is <u>N</u> or <u>L</u>, however, you may record the association on only one of the lines, and the computer will fill in the other line.

4. An association should <u>either</u> be all blank <u>or</u> have the O or X behavior only, with no line number or distance, <u>or</u> have a line number, a distance, and some behavior code (other than <u>O</u> or <u>X</u>) all present.

5. On a census it is assumed that molt, disturbance, and behavioral data will be taken. Thus, on a census data sheet, no code in any of the A or B columns means that the seal was alone, whereas on a patrol data sheet, no code may simply mean that no data were taken. It is not necessary to put an O code for each unassociated animal on census. The computer will fill this in later. If you are unable to record association data on a census for any reasons, indicate this information with an <u>X</u> for the behavior code.

Appendix C.--Continued.

6. Record all tag sightings explicitly (i.e., both left and right tag numbers) at least once during your stay. When a pup is tagged, record the first occurrence of that tag on a census data sheet for that date as well as on a tagging card. If a seal is identified via a tag, it is not necessary to determine and enter its ID number as well as tag number on the census form. The ID number will be added by computer later.

Appendix D.--Monk Seal Necropsy Report Form

(Use with "Field" Manual for Phocid Necropsies)

I. Necropsy Data:

Necropsy Performed? Y / N
Samples Collected? Y / N
Pictures Taken? Y / N
Date/time of necropsy _____
Date/time found dead _____
Date/time last seen alive _____
Location found dead: Sector _____
Beach position _____
Island in atoll _____

Necropsy No. _____
Tag No. _____
Animal ID No. _____
Temp. No. _____
Size _____
Sex _____

II. Condition of seal (check appropriate boxes):

A. Just died
☐fresh(w/i 5 h)
☐smells but firm
☐rotten
☐dried

B. ☐flaccid
☐rigor mortis

C. maggots ☐yes ☐no

D. run hands firmly over surface of body to feel for gas formation (air pockets or crackles)
☐yes ☐no

E. Additional commments:

_____

_____

_____

III. Historical summary: Include any other information pertinent to death, i.e., prior injuries, circumstances around time of death, or last sighting such as mobbing, mating, etc., odd behavior prior to death, extreme weather conditions, etc.

Injury No. _____ Entang. No. _____ Mobbing No. _____

_____

_____

_____

IV. Prosector (person(s) performing necropsy) Notetaker

_____ _____

Appendix D.--Continued.

V. [For Honolulu Laboratory use]
Receiving veterinarian/biologist _____

Date of preparation for pathologist _____

Date of submission to pathologist _____

Agency/name of pathologist(s) _____

_____

Cause of death _____ Known / Probable

Secondary pathology _____

VI. External Observations

Abnormalities and markings (Include any bruise, wound, old scars, condition of skin, external parasites, etc. Attach scar card and make drawings if deemed advantageous)

A. Head eyes: _____

nares: _____

mouth (look at tongue, gums, inner cheek, teeth): _____

B. Body dorsum: _____

_____

_____

ventrum: (include examination of umbilicus here): _____

C. Limbs _____

Photographs: Note roll, frame, subject (i.e., why you are taking each shot)

_____

_____

_____

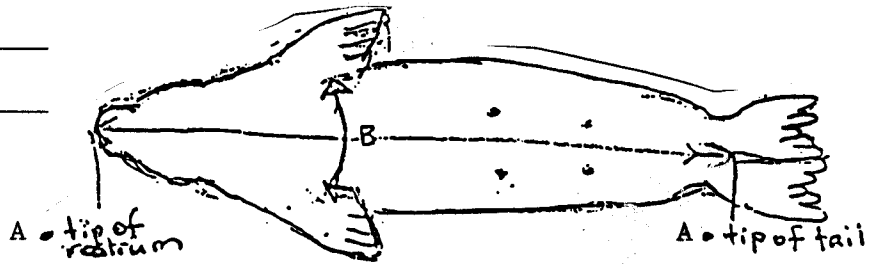
_____

Appendix D.--Continued.

VII. Measurements (take 3 with seal lying on its back)

A. Standard length _____

B. Girth at axilla _____




VIII. Reproductive status of female: Give what is known of reproductive history, i.e., dates of pupping, weaning, if she is thought to be pregnant, etc.

_____

_____

_____

_____

Was milk exuded from teats? _____

Description of milk _____

Kidneys — Weight: Left _____ Right _____ — kidneys L ☐ R ☐
Dimensions: Left _____ Right _____
Observations: _____
100g kidney for toxicology ☐

Spleen — Weight: _____ — spleen ☐
Dimensions: _____
Observations: _____

Pancreas — Observations: _____ — pancreas ☐
_____

Stomach
Omentum - if abnormal, i.e., red, thick, etc. (fat is normal), sample outer surface of stomach: _____ — omentum ☐

Appendix D.--Continued.

| | | |
|---|---|---|
| Stomach lining note ulcers, etc. Are there parasites in ulcers?<br>Ulcers: _____ | stomach | ☐ |
| Parasites: _____<br>Contents: Type: _____<br>Weight of full stomach: _____<br>Weight of empty stomach: _____ | stomach contents<br>parasites from stomach | ☐<br>☐ |
| Intestines Outer surface: _____ | intestines | ☐ |
| Lesions inside: _____ | intestinal parasites | ☐ |
| Parasites: _____ | | |
| Mesenteric lymph nodes<br>Condition: _____ | mesenteric nodes | ☐ |
| Liver Surface observations (include color, texture, rounded versus sharp edges): _____<br>Weight: _____<br>Observations upon slicing lobes (of cut surfaces): _____<br>Parasites: _____ | liver<br>liver for toxicology (100g)<br>liver parasites | ☐<br>☐<br>☐ |
| Gall bladder--bile (include bile color): _____ | gall bladder | ☐ |
| Thoracic cavity<br>Lung pleura: _____<br>Diaphragm: _____ | | |
| Thymus (largest in pup, may be absent in adults)<br>Weight: _____ | thymus | ☐ |
| Skull | skull | ☐ |

Appendix D.--Continued.

| | |
|---|---|
| Brain | brain ☐ |
| | brain for toxicology (100g) ☐ |
| Additional notes: | additional samples collected: ☐ |

Appendix D.--Continued.

"The Pluck"
Pericardial fluid: Amount _____ Color _____

Heart
External examination: _____
_____
_____
Internal examination
Parasites in chambers: _____
Parasites in pulmonary artery: _____
Plaque in pulmonary artery: _____
Other: _____
_____
_____
_____

whole heart ☐
or
heart muscle ☐

heart parasites ☐

parasites in pulmonary artery ☐

plaque ☐

Lung
Tissue examination: _____
_____
_____
_____
_____
_____

lung L ☐
R ☐

note area where sampled i.e., tip, middle of lobe, dorsal, ventral
_____

Trachea and bronchi
Abnormalities: _____
Parasites: _____
Weight of lung: Right: _____ Left: _____

airway parasites ☐

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